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WOOD'S MEDICAL AND SURGICAL MONOGRAPHS

TREATMENT OF SYPHILIS OF THE NERVOUS SYSTEM BY JULIUS ALTHAUS, M.D., LOND.

RAILWAY INJURIES: WITH SPECIAL REFERENCE TO THOSE OF THE BACK AND NERVOUS SYSTEM IN THEIR MEDICO-LEGAL AND CLINICAL ASPECTS
BY HERBERT W. PAGE, M.A., ENG.

CAUSES AND PREVENTION OF PHTHISIS
BY ARTHUR RANSOME, M.D.

WILLIAM WOOD AND COMPANY PUBLISHERS
56 & 58 LAFAYETTE PLACE NEW YORK

VOLUME 10 NUMBER 1

APRIL 1891

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APRIL, 1891

1881 87
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NEW YORK
WILLIAM WOOD AND COMPANY
1891

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ELECTROTYPED AND PRINTED BY
THE PUBLISHERS' PRINTING COMPANY
30 & 32 WEST 13TH STREET
NEW YORK

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TREATMENT OF

Syphilis of the Nervous System

BY

JULIUS ALTHAUS, M.D., M.R.C.P. Lond.,

Senior Physician to the Hospital for Epilepsy and Paralysis, Regent's Park.

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TREATMENT OF SYPHILIS OF THE NERVOUS SYSTEM.

Prophylactic Treatment.

The treatment of nerve-syphilis should be first prophylactic, and second curative.

The somewhat stale, but nevertheless highly-important, principle that "prevention is better than cure," could hardly be more strikingly or efficiently illustrated than by the subject to which I now venture to ask your attention. Nerve-syphilis is under any circumstances one of the gravest diseases with which we have to contend in practice. It is, when left to itself, almost invariably fatal, having no tendency to spontaneous improvement or cure, but, on the contrary, a strong drift toward deterioration and death. Even if judiciously and energetically treated, it has generally proved more fatal than either typhoid fever or pneumonia; and although the patient's life may be spared, he may yet be left permanently disabled, so as to be a burden to himself and his friends; while it happens only too frequently that when we have succeeded in removing the symptoms, and apparently restoring the patient's health, we are confronted with a sudden and severe relapse, perhaps at a time when we least expected it. From whatever point of view therefore we may look upon the malady, it becomes clear that we have to deal with a formidable and determined enemy, and that we should do everything in our power, not only to repel but to prevent his invasion.

The prophylactic treatment of nerve-syphilis resolves itself into two distinct lines of action. The first and most important of these should be, to destroy the virus in the beginning of the disease; while the second is, to strengthen the nervous system of the patient who has had syphilis, by every means

in our power, so as to impart to it the highest possible degree of efficiency and resistance to the invasion of the complaint.

1st. For destroying the virus in the beginning, I would recommend the excision of the primary sore wherever this is practicable. Although there is still much discrepancy of opinion on this point, yet the balance seems during recent years to incline strongly in favor of excision—a proceeding which appears indicated, not only *prima facie* by a common-sense view of the question, but is also supported by a not inconsiderable body of direct practical evidence, which I trust may soon be much increased.

There will, however, always be a number of cases in which excision cannot be practised, on account of the situation of the sore; nor would I recommend the surgeon to trust in any case to excision alone. We cannot excise lymphatic glands which may be already affected when the patient comes under treatment, and some of which may be in inaccessible positions, as for instance in the iliac fossa. Probably all that can be claimed for excision of the primary sore is, not that it will absolutely prevent blood-poisoning, but that it will greatly attenuate it. I would therefore under any circumstances add further specific treatment, even in cases where excision has been successfully practised, should only the slightest secondary symptoms make their appearance.

That mercury possesses positive germicide virtues in the earlier stages of syphilis, when we have simply to do with blood-poisoning, and when the disease has not yet encroached on the substance of important organs—in other words, when it is only a blood disease, and has not yet become a flesh-and-blood disease—appears to me as well established as any other fact in therapeutics. Let me on this point quote the experience of a contemporaneous surgeon who has devoted a whole lifetime to the observation and treatment of these earlier stages of the disease, and who has had ample opportunities of following up the subsequent history of patients who have had syphilis in their earlier years. I allude to Mr. Henry Lee, whose special experience on this point is probably unrivalled, and who has recently stated that, when the patient has been in the first instance under a mild and sustained course of mercury of from eight to twelve weeks' duration, he cannot recall a single instance where the bones or the nervous system have been sub-

sequently affected. In order that this action may not be interfered with, he considers it essential that the patient should not be exposed to cold air or cold water, and recommends that small doses of iodide of potassium should be given to assist the action of the mercury. He does not believe that the necessary action can be maintained by mercury given internally; for if thus continued for a sufficient time and in sufficient doses, the drug is sure to disorder the bowels, and it will then have to be discontinued. When, however, the action of mercury in the system has subsided, it is difficult to renew it, for the system has in some sense become proof against it, and there is no way of properly completing the course. Mr. Lee prefers the calomel vapor bath to all other modes of administering mercury, as he finds that its action on the skin tends to develop the disease there; it prevents salivation; it leaves the bowels unaffected, and may be continued any necessary length of time. If by being cured is meant that patients after proper treatment remain in future free from symptoms, do not infect their wives, have healthy families, and live as long as others, then he firmly maintains that syphilis is as curable as any other disease.

Mutatis mutandis, the same or nearly the same opinion has been expressed by other highly-experienced surgeons. I will here only quote Fournier, who says that syphilis which has been in the beginning well treated with mercury, is *peu de chose*. The patient may have roseola and papules, mucous tubercles in the mouth and elsewhere, enlarged glands, some baldness, headache and pain in the limbs; but he is not liable to any grave lesions. This view of the matter agrees so thoroughly with my own experience, that I think we may take it for granted that mercury, efficiently given in the earlier stages of syphilis, acts as a true germicide, leaving the patient's constitution uninjured to such an extent as if he had never had the disease.

Very different, unfortunately, is the aspect of things in cases where either no mercury has been given, or where this treatment has been prematurely broken off, or been accidentally interfered with. In such cases it is indeed not absolutely certain that the patient will eventually develop specific nerve disease, which may ruin his health, cloud his intellect, and finally destroy life; but there is at least the possibility, and in

some instances a strong probability, of such an occurrence actually taking place.

I will here advert to the nearly unanimous opinion of those who have seen most of nerve-syphilis, and which is to the effect that this is particularly apt to follow in cases where the symptoms have been unusually mild. Then the patient undergoes treatment for perhaps a few weeks only, after which all signs of the disease which have attracted his attention may have completely vanished. He believes himself cured, discontinues treatment prematurely, and thus lays the foundation for subsequent attacks of epilepsy, hemiplegia, and general paralysis. His constitution remains tainted with a subtle poison, of the presence of which in the system there may be no immediate evidence; and although perhaps nothing terrible may happen to him if the lines of his life are laid in peculiarly smooth places, and if he should be free from a neurotic predisposition, yet the system's powers of resistance to unusual occurrences and accidents of life are greatly diminished, and a catastrophe is more easily induced in such persons than in others. Anxiety, grief, and excitement; fatigues and privations; exposure to wet and cold; injuries to the head and other accidents, are more prone to beget serious consequences in such men than in those who have not had syphilis; while any departure from the ordinary rules of hygiene, more especially excesses in alcohol and sexual indulgence, and last, not least, hard intellectual work, may act as exciting causes of the outbreak of one or another of the various forms of nerve-syphilis.

Such being the case in persons who have no neurotic antecedents, either in their own life or that of their ancestors, matters become much more serious where there is such a tendency, as shown by the previous occurrence of nervous disorders in some of them. Where there has been epilepsy, paralysis, insanity, St. Vitus's dance, megrim, neurasthenia, or simply undue excitability of the nervous system, the liability of the latter to suffer from the additional taint of syphilis is largely increased. Out of 281 cases in which I have made notes on this point, I find that a neurotic tendency had existed previous to infection in 167, that is, in 59.9 per cent, a very considerable proportion, but which is probably still actually below the mark, since more especially hospital patients are often quite unable to give any reliable information on such matters.

2d. This leads me to the second point in the prophylactic treatment of nerve-syphilis—viz., that it is our duty by every means in our power to brace up the nervous system of patients who have had syphilis, so as to enable them as much as possible to resist any inroads of the disease on that vulnerable organ. From this point of view a tonic plan of treatment, in the widest sense of the term, is indicated after the mercurial course is finished, more especially in those in whom the earliest phases of the disease may have been neglected. The patient should, if possible, take a month's or six-weeks' holiday, preferably a sea-voyage; live as much as possible in the open air; have a course of medicinal treatment, into which phosphorus, quinine, and arsenic enter; while the state of the secretions should be carefully attended to with such means as Carlsbad salts and podophyllin, and the skin stimulated by hot sponging in cold weather, and cold sponging in hot weather, with a certain proportion of liquor ammoniæ added to the water. He should live plainly and according to rule, avoid excitement and hard work for a considerable time to come, and steer clear of sexual and alcoholic debauches. If such rules as these are strictly followed for some years, the chances of an outbreak of nerve-syphilis are considerably lessened, even in those who are constitutionally predisposed to nervous disorders.

I now proceed to the second portion of my discourse, and shall consider, first, the curative treatment of specific primary lesions, and second, that of ordinary secondary changes being consecutive to the primary lesions.

Curative Treatment of Nerve-syphilis.

1st. *The Treatment of Specific Primary Lesions.*—What are we to do when syphilis of the brain or other portions of the nervous system, whether as gumma, or as specific alteration of the coats of the arteries. or in any other form, has made its appearance?

Our mode of action must be determined by the fact that these lesions are, in the first instance, strictly specific; but that they will sooner or later, unless checked by treatment, lead to secondary ordinary lesions, either by simple pressure or by directly cutting off the blood-supply to the substance of the surrounding parts. The period at which these secondary changes occur can, in many instances, be determined with a

great amount of accuracy from the clinical symptoms which may be present, more especially if we have to deal with cases of gummatous basal meningitis, and subsequent disease of the arteries at the base of the brain, and softening of the corresponding cerebral areas. In other cases there may be great difficulty, or even impossibility of ascertaining this point. It is, however, certain that mixed lesions, which are partly specific and partly ordinary, occur very frequently, which is shown, not only by post-mortem examinations, but also by the fact, which is of common notoriety, that patients improve up to a certain point by specific treatment, but then cease to mend, showing that while the specific lesion has been benefited, the ordinary one has remained uninfluenced by our therapeutical procedures.

The more I see of nerve-syphilis, the more firmly am I convinced that mercury, if properly administered, acts as a true specific in all primary nerve-lesions, just as it does in the earlier manifestations of the secondary period; and that it is as such infinitely superior to any other drug or mode of treatment with which I am acquainted. Truly specific lesions are found to yield to this remedy, even if they be of the most severe character, and in a number of cases just as well at an advanced period as in the beginning of the complaint; and as they may remain uncomplicated with ordinary lesions, even after having existed for a considerable time, there is a possibility of their being completely dispersed, and the patient's health being entirely restored. So much is this the case that we need in some instances not despair of a man's recovery before he is dead, remembering Ricord's epigrammatic saying that "in the cure of syphilis everything is possible, even the impossible." Indeed most observers, who have seen much of this disease, have met with cases where the patient has, as it were, been snatched from the very jaws of death, and where he could not have recovered if his condition had been owing to any other cause than syphilis. A cure is sometimes effected, even after the patient has been ill for many years. I have lately succeeded in completely restoring a patient's health, chiefly by hypodermic injections of mercury, who had suffered for fourteen years from various symptoms of nerve-syphilis when he came under my care, viz., intense headache, epileptiform seizures, paresis of the left leg, vertigo, tinnitus

aurium, and obstinate insomnia, to which were added specific ulceration of the tongue and of the external meatus of the left ear. The patient had previously been treated with large doses of iodide of potassium, which may have prevented him from getting worse, but did not succeed in dispersing the specific lesions from which he suffered, every one of which, however, eventually yielded to mercurial treatment.

Tendency to get worse and great liability to relapses after temporary improvement or an apparent cure, are among the principal features of nerve-syphilis. A patient who has shown undoubted signs of it, and who is not treated, is as good as certain to die of it, sooner or later, with symptoms of general paralysis of the insane; while with regard to relapses we all know how trying and oftentimes apparently inexplicable they are, coming on either as soon as treatment is discontinued, or a few months or years after an apparent cure, being generally more severe than the initial symptoms, and less liable to be favorably influenced by treatment. Our object in the therapeutics of this malady should therefore be not only to relieve the patient of his present symptoms, but also to guard him against future attacks of the distemper. In order to effect this, however, a much longer treatment is required than has been found sufficient for the earlier period of syphilis. We cannot expect a patient with specific brain disease to get well by giving him iodide of potassium for six weeks, or by sending him for a month to Aix-la-Chapelle for inunction and sulphur-baths. It would be difficult to lay down any general rule as to the length of time which may be required for stamping out the distemper for good; all I can say is, that the treatment must be protracted and systematic, and should be continued, not only until the symptoms which may be present have completely disappeared, where this is possible, but for some time afterward, the length of which must be determined by individual circumstances, and be left to the discretion of the physician.

The plan of intermittent treatment has for a number of years past been greatly in favor with the profession. Fournier more especially has stated that mercury is apt to lose its effect when administered for a certain length of time. In his opinion the system gets accustomed to it after two or three months' use; and eventually no further good is done, as the

remedy appears to become inert. He therefore advises energetic mercurialization, together with treatment by iodide of potassium, for from six to eight weeks; then to have a break during which nothing is done, then to resume inunction for three weeks without iodide, after which iodide is given without mercury, and so to bring the changes between the two remedies until the patient is better. This system, which has been modified from time to time, has unquestionably yielded better results than the very short courses of treatment which were formerly in vogue, and which are unfortunately even at the present day frequently considered sufficient.

I am bound to say that I strongly dissent from the view that mercury becomes inert after a time in these cases; for experience has taught me that in many instances just the reverse happens, and that, so far from the metal losing its effect after some months' use, it is, on the contrary, apt to gain in power, when the system is constantly but slightly kept under its influence for many months consecutively. I have, more especially in recent years, carried out systematic mercurial treatment in severe cases of nerve-syphilis for two years and upward, with only occasional interruptions; with the result that not only have the patients submitted to it not suffered the slightest injurious effects from the prolonged use of this powerful medicine, but that a considerable proportion of them, whose prospects appeared *prima facie* far from promising, have thoroughly recovered their health under the influence of it. Where sufficient time has been given to this treatment, I have not met with any relapses. Indeed, since adopting the plan which I shall presently describe, my results have been infinitely better than they were formerly with the intermittent plan of treatment; and I now commence the treatment, even of severe cases of nerve-syphilis, with far greater confidence in my power over the disease than I was able to feel formerly. Although it stands to reason that serious consecutive ordinary lesions cannot be favorably influenced by this treatment, yet the effects of it upon the specific lesions themselves, more especially where these happen to be of a progressive character, put the patient in almost any case into a better position than he was in before, and often completely arrest his downward progress, which if unchecked, must have led to a speedily fatal issue.

The sudden introduction of large quantities of mercury has unquestionably proved useful in a number of cases, where, on account of the urgency of the symptoms, it appeared necessary to strike hard. Yet I have sometimes seen such mischief arising from this practice, that I much rather trust to the influence of small doses of the metal, combined with large doses of iodide of potassium given for a short time until the imminent peril is past, than run the risk of upsetting the patient's health by saturating the system quickly with the metal.

Stomatitis and dysentery are the two rocks ahead which we must above all things steer clear of in our management of these cases. While in the earlier period of the disease, mercury appears to answer best if the gums be kept slightly sore for some months in succession. it has appeared to me in the later stages, where the nervous system claims our chief attention, preferable to avoid this altogether, more especially because if it has once set in, then it is apt to become unmanageable. I remember several cases in the earlier years of my practice where the occurrence of stomatitis, caused by pushing the metal too vigorously, appeared to deprive the patients of that benefit which they might have gained from a more cautious and milder system of procedure.

Stomatitis and dysentery are not much to be feared when the perchloride is given, but are more liable to come on with the green iodide, with inunction, and in a more particularly severe form after the hypodermic injection of large doses of calomel and other insoluble preparations of mercury, such as Lang's gray oil, etc.

A number of fatal cases of this kind have lately been described by Runeberg, Kaposi, Lesser, Kraus, Smirnoff, and others. In such cases there is the disadvantage of our being unable to stop the supply of the mercury, which is constantly being introduced into the blood from the place where the injection has been made, and the metal deposited, so that the exciting cause of the mischief continues to act at a time when everything seems to depend upon the possibility of our being able to arrest its influence. Any one, therefore, who injects such doses as $1\frac{1}{2}$ or 3 grains of calomel at a time, and that every four or five days, does so at his peril. Shivering fits and inflammation of the air-passages have also been observed after such injections.

How should mercury then be administered in nerve-syphilis, when a protracted course of the metal is required?

The internal use of the drug encounters under these circumstances the same objections which may be made to it when used in the earlier stages of the distemper. It disorders digestion and causes diarrhœa; and has on this account to be discontinued, often before any remote effects may have become perceptible. The same remark applies to its introduction by the rectum, by means of suppositories. We may introduce the metal by washing the skin with mercurial soap, as recommended by Oberländer and Schuster; or by applying mercurial plasters and belts—an old method which has recently been revived by Quinquaud, who recommends a calomel plaster about three inches square to be applied to the region of the spleen for a week at a time, then to be left off for a week, to be resumed in the third week, and so on. Then we have Mr. Henry Lee's calomel vapor-bath, which is of such great advantage in secondary syphilis; and, above all, inunction, which has long been considered the most energetic mode of treatment, but which has a certain number of drawbacks that tell strongly against its habitual use. It is in the first instance a very dirty proceeding, and one most repugnant to the feelings of the patient; it is apt to be ineffectual where the patient attends to it himself, and requires the assistance of a practised rubber; and it often leads very speedily to severe stomatitis and diarrhœa, probably owing to the inhalation of mercurial vapor, which is set free by friction, aided by the extraordinary faculty which mercury has of evaporating and diffusing itself into the atmosphere at all temperatures, but more especially in hot rooms or during hot weather. In hospitals, and even in private rooms, those who attend upon or habitually live with patients subject to inunction, are for this reason exposed to receive the mercury into their blood by inhalation; and the urine of such persons has been found to contain quite as much mercury as that of the patients themselves. Finally, relapses are very common after this mode of treatment, more especially when it has been practised for a short time only.

These and other drawbacks have induced therapeutists for a number of years past to substitute the hypodermic injection of different preparations of mercury for the earlier methods of using the metal. The advantages claimed for injections are

that they are cleaner than inunction; that the dose given can be more exactly measured; that they are more effective, one injection doing as much good as ten or twelve inunctions; that the attendants remain free from the influence of the drug; and, finally, that relapses are rarer.

The different phases through which the hypodermic injections of mercury have passed are so recent and well known that I need not enter into them here. Suffice it to say that Berkeley Hill appears to have been the first to inject the soluble perchloride, and Scarenzio the first to employ the insoluble subchloride; but the names of Lewin and Liebreich, who have largely practised the injection of the perchloride and the formamidate, are more particularly connected with this mode of treatment, which they have done so much to introduce to the notice of the profession. The chief drawbacks of the soluble preparations, such as the formamidate, the peptonate, the benzoate, etc., have been found to be that they are too quickly eliminated, and that there is a difficulty in bringing the system under the influence of the metal, except by daily injections, which would be inconvenient for private practice. On the other hand, the principal objections to the insoluble preparations are, that they are apt to cause severe pain, and troublesome swellings and abscesses, as well as sudden and violent stomatitis and dysentery, which cannot be effectually combated, because absorption may still go on from the deposit which has been formed at the place of injection.

I have during the last twelve years injected a very considerable number of both soluble and insoluble preparations of mercury in the treatment of nerve-syphilis; and have taken a great deal of trouble, undeterred by numerous failures, in endeavoring to discover the best way of preparing the drug for entrance into the system, and the most advantageous method of using it with regard to dosage and continuance. The general result of my researches on this point has been that the periodical and long-continued injection of small doses of a non-irritant insoluble preparation is the best mode of employing the metal, and one with which one may go on without fear of disordering the system for a considerable time. If sufficiently persevered with, this mode of treatment tends more than any other with which I am acquainted to rid the system of all traces of the syphilitic poison, to remove present symptoms

which are owing to the latter, and to guard the patient against future attacks of the malady.

As the method which I am in the habit of using, differs considerably from those which are employed by others, I will now describe it in full.

1. The preparation I use, consists of one part of metallic mercury, thoroughly rubbed up with four parts of purest lanolin, and then well mixed with five parts of carbolic oil of 2 per cent strength. This forms a gray cream which is sufficiently fluid for injection, and ten minims of which contain one grain of metallic mercury. It is absolutely indispensable in preparing the cream that the whole of the mercury should be "killed" or extinguished, so that no metallic globules are visible at the bottom of the bottle. If any such should appear, the medicine has not been properly prepared, and should be returned to the dispenser. A well-made cream has, to begin with, considerable pharmacological advantages over other preparations which are in use. In the first instance, it constitutes a perfectly homogeneous mass, by which it is distinguished from those containing calomel in suspension, from Lang's gray oil, etc. This is a more important consideration than might appear at first sight; since it must be evident that, with a uniform mixture, the dose which it is intended to give can be much more accurately measured than with a mere suspension, which has to be shaken before it is used, and in which the active principle, being heavier than the vehicle, is apt to sink to the bottom, and is therefore unequally distributed. Indeed, in the ordinary calomel-oil, the calomel is at once precipitated on standing, and it is impossible to divide it equally. It has appeared to me on perusing reports of cases in which such an injection has produced untoward results, that the dose which caused the mischief may, for the reason just given, have been much more considerable than was intended. My carbolized mercurial cream, when examined with the microscope, shows no metallic globules, but an absolutely homogeneous mass throughout, in which all the ingredients are perfectly blended.

Another pharmacological advantage of this cream is its great stability. Many preparations which have been recommended are apt to become rancid or decomposed, or too stiff for injection, in a comparatively short time, and require con-

stant renewal and fresh making up, which constitutes a great drawback in practice. I have kept a sample of the mercurial cream for six months, after which it was as good as on the day when it had been prepared. It is true that, when it has been standing for some time, a few drops of the oil are apt to separate and rise to the surface, but on stirring the mass with a glass rod for a few seconds, it at once becomes quite homogeneous again; and owing to the antiseptic properties of the carbolic acid, the cream never turns rancid.

2. A very considerable advantage of the carbolized mercurial cream is, that its injection is habitually quite painless. Some patients are indeed so excessively sensitive to injections that they complain of pain after the injection of distilled water, and, in two cases out of forty-one, complaints of pain have been made to me after the injection. This, however, is quite exceptional, and occurred in hypersensitive persons who resented any other slight manipulation, for instance, eliciting the knee-jerk, equally keenly. In these two cases, however, only seven injections were made against nearly 1,250 in the other thirty-nine cases, which were completely painless. This habitual painlessness of the hypodermic injection of the cream is no doubt owing to the circumstance that carbolic acid has the property of blunting the sensibility of the terminal branches of the nerves with which it comes in contact, and thus rendering them incapable of transmitting painful impressions to the nerve centres. For the same reason, a solution of carbolic acid in water has been used with success for the relief of obstinate local neuralgia. The injection of the cream produces habitually a pleasant warm feeling in the part, which lasts for a few minutes, after which the patient is no longer reminded that anything unusual has taken place. How different is this from injections of the perchloride, of calomel suspended in oil, liquid gum, water or salt-water, liquid paraffin or benzoic ether! Such injections I have known to cause severe pain for several days, and occasionally for more than a week, even when morphine or cocaine had been added to them. Shoemaker, MacCall Anderson, Tacke, and others, have recommended to inject morphine or cocaine either before, or together with, or after, the injection of the mercury; and I have given this a patient trial, but on the whole with unsatisfactory results. Indeed, the pain often begins to be particularly severe on the

second or third day after the injection, when the effects of the morphine or cocaine have long passed off.

3. Many soluble, and all insoluble, injections which have been recommended are apt to cause hard swellings from the size of a cherry-stone up to that of a walnut, which appear on the second or third day; are hot, inflamed, and tender, and cause great inconvenience in walking, standing, or even lying in bed. They sometimes disperse in a week or ten days, but in other instances an abscess is formed, which breaks toward the tenth day or so, and may go on discharging for a fortnight or even longer. It may take six weeks before such an abscess is quite healed. In the discharged matter globules of mercury may be discovered, showing that the quantity intended for absorption has not been all taken up, but that some of it has remained *in loco*, and has been lost. I have never seen such hardening or abscesses produced by the injection of the cream, which I believe to be owing to the circumstance that carbolic acid tends to prevent inflammation and suppuration in any parts submitted to its action. I will, however, not go so far as to say that such a swelling could never occur, for I have once seen it caused by a hypodermic injection of distilled water in a highly sensitive person.

For the prevention of abscesses, authors have recommended the most elaborate antiseptic precautions, such as first washing the skin with soap, alcohol, carbolic acid, and mercuric perchloride; cleaning the syringe by first filling it with absolute alcohol, or a solution of sublimate; drying the canula over a spirit-lamp, and then anointing it with carbolic oil; injecting liquid paraffin before the mercury; using salicylic cotton-wool for wiping away the first drop of the mercurial preparation which appears at the point of the canula; covering the puncture with iodoform collodion, and letting the patient lie on his abdomen for some time after the injection, and applying electricity and massage to the puncture! All these multifarious proceedings may be dispensed with if the carbolized mercurial cream be used, scrupulous cleanliness of the syringe alone being required. The parts remain, as a rule, soft and in their ordinary condition after such an injection, as if nothing had happened.

4. The average dose of the mercurial cream which I am in the habit of using, is five minims, injected once a week into

the glutæi muscles. This amounts to half a grain of mercury, but as nearly a minim is lost by some of the substance adhering to the walls of the syringe and canula, the dose which really enters the circulation is somewhat less, viz., about two-fifths of a grain. I have rarely found it necessary to exceed this dose, and have given even less in anæmic and ill-nourished persons, with whom any form of mercury is so apt to disagree. I should also inject less in women, who do not bear hypodermic injections, in general, so well as men.

Where the effect appears to be tardy, I have preferred giving iodide of sodium at the same time, so as to retain the mercury longer in the system, rather than injecting larger doses of mercury, which might cause anxiety as to the possible occurrence of stomatitis or dysentery. Where the teeth and the mouth generally are in a bad state, I give chlorate of potash, both externally and internally for a time. In some cases the glycerinum acidi carbolici, diluted with water, answers still better as a mouth-wash.

The dose which I recommend is, therefore, about one-fourth of that which is habitually used; in other words, I spread over a month what is generally given in a week, or even in four or five days.

5. The hypodermic injection of the carbolized mercurial cream is highly effective in cases of truly specific lesions of the brain, spinal cord, and nerves, as shown by the steady improvement, and in favorable cases by the eventual disappearance of the symptoms of gumma and arterial disease. By "favorable cases" I mean those which have remained uncomplicated with severe ordinary secondary lesions. There were thirteen such cases out of forty-one thus treated. Specific eruptions and ulcerations, which are not infrequently present at the same time, heal well under the influence of this treatment, sometimes after having existed for years. The patients generally express themselves as feeling better a day or two after the injection, in the beginning of the treatment. The bowels often act with more freedom on the first two days than during the remainder of the week. I have often seen the tongue, which had been dry and furred, become moist and clean, while appetite and digestion improved, and a general tonic influence was manifested, owing, no doubt, to the neutralization of the toxines which previously infested the system.

The elimination of mercury from the blood and the tissues takes place by the saliva, sweat, the secretions of the liver and intestines, and more especially by the urine. In the latter it can be shown by Fürbringer's and Almén's methods, between twelve and twenty-four hours after the injection.

The principal excretory organ of mercury being the kidneys, it behooves us to see that they are in good condition before commencing this treatment. Kaposi lost a case, which he treated with injections of Lang's gray oil, where there was albuminuria. In case we should discover this latter condition, before or at any time during the treatment, we should either not resort at all to the hypodermic injection of mercury, or practise it with extreme caution, and in much-diminished doses. I have, however, not met with albuminuria in any of the cases which I have submitted to this treatment.

There is still much diversity of opinion about the value of iodide of potassium in the treatment of nerve-syphilis. Some authors look upon this salt as our sheet-anchor in the management of these cases, while others reject it altogether, and credit it with harm rather than good, more especially if given in those large doses which are now generally thought advisable if it is to be given at all. No one can be more convinced of the value of this medicine in rapidly combating and arresting dangerous symptoms of nerve-syphilis than myself; but I have not found it to possess actually curative properties. Where I have in former years trusted to this drug to the exclusion of mercury, I have almost invariably had imperfect results, and endless relapses; and I can therefore assign to it only a secondary place in the treatment of these affections. It is, however, in general indispensable where there is danger in delay, and should then be given in tolerably large doses, and, if necessary, by the rectum. Some physicians are disinclined to exceed a dose of five grains, while in the United States as much as 120 grains are given as a dose, even to a child. I rarely give less than twenty or more than forty grains as a dose, and have with this generally attained the end I had in view. Iodide of sodium is often more easily borne than the potassium salt. A portion of the effects of the drug is probably owing to its impeding the elimination of mercury from the system, where this is used at the same time, and thus promoting the action of the principal drug.

I have not seen any truly specific effects from other drugs, such as gold, sarsaparilla, stillingia, and others which have from time to time been in favor. I have, however, formed a high opinion of the value of a general tonic plan of treatment, more especially in cases of long standing, and where the powers of the system in general have been much reduced. Where the patient's general health is fairly good, the mercury alone seems to act as the best tonic, no other strengthening medicine being required. But where there is wasting and inadequate functions in general, quinine, cod-liver oil, and malt extract should be given. The latter is very useful in combination with pepsin, pancreatin, and the hypophosphites. The diet should be nutritious and easily digestible. The patient must lead a quiet life, avoid excitement and worry, late hours and violent exercise, and more especially shun any excesses in drinking and sexual indulgence, which latter are the most dangerous of all. Excessive smoking—which is so apt to lead to the abundant eruption of mucous tubercles in the mouth and tongue in the earlier stages of syphilis—is hurtful in nerve-syphilis, more especially where reflex excitability is unduly increased, as in cases of specific epilepsy, hemiplegia, and spastic spinal paralysis. In such cases smoking should therefore be entirely prohibited or greatly reduced.

2. *Treatment of Secondary Ordinary Lesions.*—I regret to say that I am unable to recommend any truly specific remedies for the secondary ordinary lesions which are apt to follow in the wake of the primary specific changes; nor is it likely that any such will ever be discovered, seeing that there is no such reproductive power in the central nerve-cells as we find, for instance, in the peripheral nerves. On the whole, however, I consider the constant current of electricity the most useful agent in the treatment of these secondary lesions; for although it cannot restore destroyed nerve-cells, it often does much good by promoting nutrition where nerve-tissue has been simply damaged, and by improving the circulation of the blood in the affected vessels. For this purpose central galvanization with a large electrode on the epigastrium, and another smaller one applied successively to the forehead, vertex, mastoid processes, and cervical vertebræ, with a current-strength of from one to five milliampères, applied for from ten to fifteen minutes, according to circumstances, is the most

generally useful mode of employing the electricity. In cases where the seat of the lesion can be very accurately localized, for instance, where the motor region of the cortex is suffering, the corresponding points of the head should be more particularly acted upon; and the direction of the current should be changed once during the application, so that the nervous areas acted upon receive alternately the influence of the positive and negative pole. The current often proves of benefit in the distressing headache and the various neuralgic pains from which these patients are so apt to suffer; it improves sleep, and allays the undue excitability of the nervous system which so often accompanies local lesions.

In syphilitic disease of the spinal cord, faradization of the skin by means of a large wire brush seems sometimes more effectual than the constant current.

A most valuable application in cases of brain-syphilis is cold to the head by means of Leiter's tubes, which often acts better than morphine, antipyrine, the bromides, and chloral. These last-named remedies, however, may also be necessary in severe and obstinate cases. Finally, we must do everything in our power to strengthen and support the patient's *morale*, and cheer him up in his mental and bodily sufferings with prospects of eventual recovery, or at least substantial improvement, wherever this can be reasonably expected.

In bringing these remarks to a close, I venture to express the hope that the principal agent in the treatment of nerve-syphilis which I have recommended, viz., the periodical and long-continued hypodermic injection of small doses of the non-irritant carbolized mercurial cream, will be tested by you in your practice, and may be found by you to deserve the place which I have assigned to it in the treatment of these affections. If such should be the case, I shall be amply repaid for the trouble and time which I have given to the subject; and I trust that, in future, when this therapeutical proceeding shall be perseveringly used at an early period of the terrible group of diseases with which we have to battle, the prognosis of nerve-syphilis in general will become more favorable than it has been up to the present time.

RAILWAY INJURIES:

WITH SPECIAL REFERENCE TO THOSE OF THE BACK AND NERVOUS SYSTEM

IN THEIR

MEDICO-LEGAL AND CLINICAL ASPECTS.

BY

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RAILWAY INJURIES.

CHAPTER I.

INJURIES OF THE BACK.

THE aim of this book is to give an account of the injuries sustained in railway and similar accidents which become the subject of medico-legal inquiry. In a book published in 1883, "Injuries of the Spine and Spinal Cord and Nervous Shock" (Churchill, 2d ed., 1885), the results of my experience up to that time, together with the views I had been led to form of the nature of railway injuries, were placed on record. While this work is to a considerable extent founded upon the book of 1883, and draws largely from it, the scheme is somewhat different, for it is now no longer necessary to say wherein I had come to differ, and that very widely, from the opinions then prevailing as to the nature of these injuries. The task of preparing the former book had not been undertaken, it is right to say, without ample personal observation of the cases and injuries described. I had indeed been seeing them frequently during a period of nine years, and from the beginning I had resolved that I would not write a line upon the subject until after, at least, five years' experience. The four years devoted to the preparation of that book afforded time for an inquiry into the after-histories of a large number of injured persons, and a table of cases formed no inconsiderable part of it. It has been impossible again to undertake the extraordinary and systematic labor which that inquiry involved, the labor of travelling thousands of miles and the inconvenience of frequent absence from London. The length of time which was spent over the preparation of the former work has, moreover, been fully justified, for although I have more to say in the

present work than I said before, yet I have nothing to unsay as being out of accord with the later experience of eight additional years. And I have the further satisfaction of knowing that the views which I then propounded have been practically accepted by all who are familiar and have to do with injuries of this class, both in this country and in America, as well as in France, Germany, and elsewhere. It is unnecessary, therefore, again to travel over the ground which was formerly occupied in dealing with concussion of the spinal cord and "concussion of the spine." The theory which attributed the nervous symptoms after railway injury to meningo-myelitis of the brain and spinal cord no longer meets with general acceptance ("est définitivement abandonnée" is the expression of a French writer, Dr. Dutil), and it is hardly likely to regain it in the future, unless it has the support of more pathological and clinical facts than were originally adduced in its favor. The consequences of railway injury are happily not so grave as that theory demanded, but they are none the less deserving of attention because of the serious, albeit usually transient, effects which are wrought upon the nervous system by this form of accident.

Renewed attempts have been made in recent years to unravel and explain the complex nature of collision injuries; and by many writers in this country and abroad, by Thorburn, Dreschfeld, Ross, and Collier here; by Weir Mitchell, Dana, Hodges, Putnam, and others in America; by Charcot and many of his disciples, by Guinon and Berthez, Moricourt, Terrier, and Vibert in France; by Oppenheim, Strümpell, Bernhardt, and Westphal in Germany, and by a host of others, fresh light has beeen shed upon the traumatic psycho-neuroses and on the hysterical and neurasthenical conditions which are prone to ensue from the profound mental disturbance, and the shock to the whole nervous system, which a railway accident causes. This practically was the view which I sought to uphold, that most of the strange nervous symptoms so commonly seen after railway accidents were not due to physical injury sustained by the spinal cord, but were the more or less immediate concomitants of the profound mental emotion aroused by the unquestionably special features and incidents of every collision. And I endeavored to show how the accompaniment of some form of injury to extra-spinal, muscular, and ligamen-

tous structures was at the root of the entirely erroneous notion that the nervous symptoms were due to lesion in that part of the central nervous system which has its seat in the spinal column. The further experience gained since I last wrote has confirmed the opinions which I then expressed; and the extensive opportunities which I enjoyed of studying this class of injuries during my seventeen years' tenure of the office of Surgeon to the London and North-Western Railway Company, warrant me now in laying before the profession in a more comprehensive manner what I have to say on the subject of railway injuries.

The book makes no pretension to be a text-book of nervous diseases. It is simply one chapter in their history; and if for convenience' sake it is itself divided into chapters, it is as one chapter on the subject of which it treats that it must be read. The various parts of it are meant to hold together, and if the statements made are not every one of them supported by the published record of individual cases, none the less are they founded on actual experience and observation. I have throughout endeavored fairly and evenly to hold the balance, bearing in mind that no work upon such a subject can be, as I am desirous this should be, of use to others, unless it is conceived in a judicial spirit, and is free from partiality and bias.

The object of this chapter is to give an account of the spinal injuries which are so frequent in railway collisions. It is, of course, true that injuries of all kinds and degrees are caused by railway accidents, but they differ in no respect from those which are seen after any and every form of violence. Nor indeed do injuries of the back received in railway accidents differ from injuries of the back received in many other ways, but their frequency, and above all the character which they impress on the features of many other forms of railway injury, especially on those which will be dealt with in the succeeding chapters, demand for them a place by themselves, and a separate chapter for their consideration. Their frequency is a matter of no question. It has been attested by Riegler ("Ueber die Folgen der Verletzungen auf Eisenbahnen, insbesondere der Verletzungen des Rückenmarks," Berlin, 1879. Riegler gives statistics which show that, since the passing of a law in Germany for the compensation of persons injured on railways, the number of injuries or complaints of injuries had enormously

increased, and that, moreover, of thirty-six complaints after injury no fewer than twenty-eight were of the back), by every one, in fact, who has ever written on the subject of railway injuries, while among my own cases more than 60 per cent of the injured persons made some complaint at some time or other of having been hurt in the back. The influence of such injuries upon the more purely nervous effects of railway accidents it will be one purpose of this book to teach, and those who do more than merely skim its pages will find how true it is, that the complexion of the other injuries to be described may be at times affected, or even changed, by them.

I will speak in the first place of the more common injuries of the back received in collisions on railways or in other similar accidents, and will refer afterward to those conditions or symptoms, which indicate that there may have been injury to one or other of the nerve elements of the spinal column. And it may be well to premise that in none of the cases quoted was there any reason to suspect the perfect *bona fides* of the injured persons. The following is a very frequent occurrence. A man has been in a collision; he was perfectly conscious at the time that he met with no blow—knows, in fact, exactly what occurred to him when the accident happened, and yet he finds that within a few hours, occasionally much sooner, he is seized with pain in his back. What has happened to him? Let us look at a case where the symptoms were simple and unobscured by other injury.

Case I.—*Simple Lumbar Sprain—Traumatic Lumbago.*—M. A., a strong and active man, was riding in a first-class carriage, when a slight collision took place. He was, at the moment, leaning forward reading, and was not even moved from his seat. He felt a little upset and shaken, and had some brandy in consequence, but he was able in a few minutes to set off and walk to his business. The next day he felt some pain in the lumbo-sacral region, which on the following day became acute, especially on movement, and on the third and fourth days after confined him to the house. He was ordered a belladonna plaster, and in a week he began to improve, though having occasionally sharp pain. There was no local tenderness, and it is evident from the history that the injury in this case was a simple sprain of the muscles and ligaments

about the lumbo-sacral region. It was, in fact, a "traumatic lumbago."

In a slight collision like this it is very common to hear that the passenger was thrown backward and forward in the carriage, and although this man had hardly been moved, the sudden arrest of the train is frequently the means of jerking the traveller from his seat, and perhaps landing him upon the floor. Now it is that the physical structure of the spinal column exposes it to this form of injury. Endowed with extreme mobility in every direction, forward, backward, in rotation, and from side to side, as provided by its many articulations and by its thousand muscular and ligamentous attachments, it nevertheless has to guard the spinal cord within its central canal. To do this well, both conscious and unconscious effort is made at the moment of the collision to hold the column rigid, and as a result of the violence and of the sudden resistance induced by "setting" of the muscles and ligaments, the ligaments and muscular attachments are strained, overstretched, and, it may be, even ruptured in the dorso-lumbar or lumbo-sacral regions of the column. The injury is precisely the same as that which is met with every day, where a man complains that while lifting a heavy weight he suddenly felt a severe and acute pain, which almost prevented him from moving, in the lower part of his back. You examine him and can find no external sign of injury, but he hesitates to stoop when you ask him, he holds his back unnaturally stiff, he finds it difficult or impossible to rise from his seat, and very likely there is some local tenderness in the muscular mass on either side of the lumbar vertebræ. We may meet with the same injury in very different degrees of severity, and the pain may be felt at an altogether different part of the spinal column.

Case II.—*Cervico-dorsal Sprain.*—A man aged forty-two was in a train which ran (without time for warning) at fifty miles an hour into a coal train standing on the line. He was thrown suddenly forward, and instantly felt acute pain in the cervico-dorsal region. The pain was never again acute, but a weary aching was felt at the part for several weeks, both over and on each side of the spine. There were no other indications of injury, and the nausea and feeling of faintness experienced at the moment of the accident soon passed away. Obviously

the injury in this case was of precisely the same nature as the traumatic lumbago already named. The spinal injury may, however, be even more widespread.

Case III.—*Sprain of the whole Vertebral Column.*—A rather smart collision caught a man, aged fifty-eight, sitting upright in the carriage with his head slightly turned to one side. He was thrown back, and his head was knocked against the partition, the brim of his hat fortunately saving him from a severer blow. He felt shaken and sick, but did not vomit. Within a couple of hours of the accident he was seized with pain, and tenderness was felt in the lower part of the back, especially over the two lower dorsal and two upper lumbar vertebræ. He was taken home and put to bed, where he lay for a month, suffering at first from such severe pain throughout the whole spine—cervical, dorsal, lumbar, and sacral regions—that he was barely able to move. There was never any acceleration of pulse, elevation of temperature, or peripheral pain. At the end of the month he began to improve, and was able to move his arms and his head without pain, and occasionally to sit up in bed. In a couple of months he was able to get up, and in three months to move about so well as to do a little business. He gradually recovered, and five years after the accident was reported to be in good health, although he still felt an "uncertainty" when travelling, and unless he carefully supported himself was liable to have a return of pain in the lower part of the back.

These cases afford good examples of the same kind of injury, though affecting different parts of the spine. It is unusual, however, to meet with cases such as these where there is no other complication. "Nervous shock" in its varied manifestations is so common after railway collisions, and plays so prominent a part in all cases which become the subject of medico-legal inquiry, whether they be real or feigned (in the "Times" of Saturday, February 19th, 1881, a case was recorded of an action against a railway company for injuries received by a man in accidentally putting his leg through a hole whereby he was thrown down and hurt his leg. The judge commented strongly on the fact that the symptoms complained of bore a strange resemblance to those heard of so frequently after railway collisions. The symptoms, I think, in such cases

ought properly to be termed "litigation symptoms," as I shall subsequently show), that we are almost sure to meet with the symptoms of it in association with pains in the back, and with points of tenderness along the vertebral spinous processes. It is this frequent combination of the symptoms of general nervous prostration, neurasthenia, or shock with pains in the back, such as these cases presented, which no doubt laid the foundation of the erroneous views which were at one time prevalent as to the nature of the common injuries of the back received in railway collisions.

A man has a general nervous shock, and at the same time he is alarmed himself, and gives continued alarm to others by the pain and tenderness, often very severe, which he suffers at some part of the spinal column, or of the structures lying contiguous to it. In the first two cases recorded there can be no question that simple muscular or ligamentous strain was the sole cause of the pain; and the entire absence of any indication of other injury shows that the cause of the pain, which extended throughout the whole spinal column, and made every movement of trunk and limb almost intolerable, was exactly the same in the third and more serious case. Cases like the last are rarely met with in ordinary practice, but railway collisions provide the conditions which determine the possibility of such extensive strain of the vertebral column. Now one part, now another, is sprained in the jerks and jolts which accompany most collision accidents, and the pain, more commonly situated in the lumbar region alone, may thereupon affect other parts of the column. And very variable may be this pain both in range of distribution and in character; and variable also the time when it may begin.

Case IV.—*Lumbar Sprain—Very Acute Pain.*—A young man who was in a bad collision began three days afterward to feel pain and stiffness across the loins, so that he moved with difficulty, and felt easiest when flat upon his back. The pain in his back gradually increased, and, to use his own words, he thought all was over with him, and that he was going to be paralyzed, for when he tried to stand up a sharp pain seized him in the back like a knife cutting into him, and shot downward and upward from the loins like an electric shock, so that he dropped upon the floor. This state of things lasted for about three weeks, during which he lay almost help-

less, and had the greatest difficulty in defecation and micturition. There was at the same time considerable local tenderness, but never any outward sign of injury. This description is almost characteristic of an attack of acute lumbago.

Stiffness, however, and local pain are not the only indications of spinal sprain. There is very often some degree of local tenderness as well, felt on pressure over one or more spinous processes, or occupying a wider area on each side of the spine, and it is important to inquire whether this is evidence of some graver injury than I have said is ordinarily signified by the local pain. My own experience lends no support to this supposition. Local tenderness is often found in cases of simple sprain of the back from lifting heavy weights, and it would be very strange if the same symptom were not found in those cases, where the spinal sprain has been caused by the severe wrenching and straining suffered in a railway collision. In the worse cases the same conditions are in all probability produced as are to be found around an ankle or other joint which has been sprained, but you cannot see the swelling about the small joints of the vertebral column and about the muscular and ligamentous attachments, simply because the structures sprained are more deeply situated, and are much smaller in size. A deep-seated discoloration, however, may be sometimes seen, even where there has been no blow. Tenderness is thus a more or less inevitable consequence of the injury, but is it by itself a more dangerous symptom than the pain on movement? Let us ask if tenderness of the back is a prominent symptom in cases of spinal cord disease which we see in our hospital wards. Is it not rather conspicuously absent, and is not a diagnosis made by a totally different train of symptoms? Any one who has ever looked at a vertical section through the centre of the spinal column, and has noted how far the spinal cord is from the surface, how the spinous processes overlap each other, and how thick is the mass of muscles on either side, must have felt convinced that all ordinary pressure on the column can have little or no effect upon the structures within. Tenderness by itself is therefore not to be regarded as an indication of grave injury to the contents of the spinal column; it is a symptom, which, if of any value at all, ought rather to reassure, as pointing to the kind of injury which we are here considering.

But although local tenderness may be of small value as evidence of intraspinal lesion, its long continuance at one spot is very decidedly suggestive of some inflammatory affection of one of the small spinal joints. "It may be deemed singular," Mr. Shaw writes in Holmes' "System" (Holmes' "System," Vol. IV., 2d ed., p. 103), "that numerous as are the small joints formed by the opposing surfaces of the oblique processes, in the posterior segment, disease is scarcely ever witnessed in them." Yet we know that these joints may be very seriously affected in rheumatoid arthritis, and that they do not escape suppuration in pyæmia. There is no inherent reason why one or more of them should not occasionally be affected by a simple synovitis, such as is seen in other and larger joints as the result of injury. Traumatic synovitis of a spinal joint is doubtless extremely rare, but it may be occasionally the cause of otherwise inexplicable tenderness and pain.

The three most prominent and distinctive signs of simple sprain of the back commonly met with are stiffness, tenderness, and pain, and we have seen that these may be present at any part of the spinal column, or may even involve the whole of it. This widely-distributed "lumbago"—if the term may be allowed to indicate the aching and the pain on movement throughout every part of the spinal column—may of itself give rise to a form of pseudo-paralysis, which, if unrecognized, may cause unwarranted alarm. The pain in all movements may be so great, whether the movements be of the limbs, of the body, or of the head, that the patient is really afraid to move at all. This well-grounded fear of moving may soon assume the importance of an absolute inability to move, especially when the sprain has chiefly affected the lumbar and lumbo-sacral regions. Ask any man who has had a severe lumbago, whether from a sprain, from rheumatism, or from cold, if he has not at the same time felt a strange sense of difficulty in moving his legs. Brisk walking becomes impossible; the effort needed to put one leg before the other must be unnaturally great; fatigue comes early, and the patient complains to you that his legs feel weak, and as if he could hardly move them. The injury may frequently be diagnosed by the peculiarity of the gait alone.

Micturition may at the same time be interfered with, from lack of the natural support and help which the lumbar mus-

cles provide when this act is being performed. The patient, perhaps, cannot completely empty his bladder, and there is a certain amount of dribbling at the close of the act. It thus appears to himself that his "water runs from him," and if, as a consequence of slight retention, there be added some irritability of bladder, symptoms of somewhat ominous import seem to be developed. Many men find it practically impossible to empty their bladders when they are laid upon their backs, and "residual urine," recognized as perhaps the most frequent cause of cystitis, is very prone indeed to occur as the indirect result of any injury which dooms a man to bed. And this may arise quite independently of any retention due to shock, to which reference will be found at p. 72. It is obvious, therefore, that sprains of the lower back provide the very combination of conditions likely to lead to this result, and every now and then we find that trouble with the bladder may rise into considerable prominence. Especially is this likely to happen when the nervous system has been much upset by the shock of the accident, and you may find a condition of "nervous bladder," in which the patient has a frequent desire to pass water, with inability at the same time to perform the act perfectly, and consequent slight dribbling at its close. Constipation also arises from the same muscular incapacity, and becomes an almost invariable feature in the case. Thus it is nothing more nor less than natural for the friends to say that the patient is "paralyzed," and paralyzed from severe injury to the spine. If you do not avoid these fallacies, and do not correctly interpret this state of things, you will add greatly to the dread, which after railway collisions is strangely real, that "paralysis" is going to supervene.

This very natural fear of paralysis is still further increased by the abnormal sensations incidental to the muscular and ligamentous incapacity. There is a strange feeling of weakness in the legs, and the patient complains to you that he cannot walk, or that his legs give way when he makes the attempt to do so. Repeated observation, however, leaves no doubt in my mind that these results are more dependent on the fear of moving (this fear of moving was strangely shown by a man who had received such injuries as have been described, who was confined to bed in consequence, and who needed three persons to help him out of bed every time he

wanted to pass water in the day-time. To himself it appeared wholly unaccountable and extraordinary that whenever he woke in the night he could jump naturally out of bed without any help for the same purpose. It need hardly be said that the case was perfectly genuine) than on any real inability to move because of nerve lesion; and the personal knowledge of many hundreds of cases, together with the absence of any record of such a consequence in medical literature, enables me to allege that there is no more cause to anticipate real paralysis after a sprain of the back received in a railway collision, than there is after the thousand and one different kinds of injury which fall under the notice of the surgeon.

In the absence of other signs of injury for which, of course, full search will be made, do not therefore let undue weight be given to this pain and tenderness at one or more points of the spinal column, or to the stiffness and pseudo-palsy which accompany them. In cases of real damage to the spinal cord or its membranes, both pain and tenderness may help to localize the point at which mischief is going on, but they do not indicate the mischief itself, nor are they in any sense pathognomonic symptoms of spinal cord disease. In no wise would I undervalue the real importance of these vertebral sprains. They may be exceedingly distressing to the patient; the pains may last for a very long time; there may even be occasional reminders of pain for months or years under suitable conditions; but it is right that we should attach no more import to them than they deserve, and their existence should not entail a needless dread of serious injury to the structures within the spinal canal.

The long continuance of pain in the back is very naturally the cause of alarm to the patient, and of doubts as to his ultimate recovery; but if the pain be rightly estimated, and its real value as a symptom of spinal disease be recognized, there will be less reason for these fears. Look at it in connection with maladies other than simple sprain. In spinal caries, for example, we know that local pain at the site of disease is not one of the most pronounced symptoms, and that it is of much less value in diagnosis than pains at the periphery, instinctive dread of leaving the recumbent posture, or an absence of natural flexibility in the spinal column when the patient moves. The pain, indeed, is indicative of nothing more serious than

muscular or ligamentous strain. In character, moreover, it may be said to be almost typical of this form of injury. Aching, weary, and more or less constant both over and near the spine, and in the muscular masses on either side of it, it is liable to be rendered acute by movement, so that the patient dreads to move at all; or if he be able to go about, it is likely to seize him suddenly and sharply, to make him cry out for the moment, and to be followed by renewed aching of the back. The spinal pains are, indeed, very like the pains which may affect any contused or sprained joint, and there is precisely the same indication for treatment. Exercise—and not fixation of the whole back in poroplastic jackets—is essentially the best thing for relieving them, after adequate rest has been given to recover from the immediate effects of the shock, and to avoid what risk there may be from too early movement of the bruised and strained parts. True, the effort necessary to move for the first time may have to be very great, and the pain on first getting out of bed or attempting to walk may be so acute as to drive the patient back to bed again, yet if this initial pain will be endured, and a little perseverance and determination be exerted, it is pretty certain that the pain will daily be lessened, and that greater freedom of movement will be gained at the same time. In a sprained joint we know that stiffness and pain go frequently *pari passu* together, and the same associated phenomena in these injuries of the back form an additional aid to the diagnosis that the spinal pains are not of more serious import, than those due to muscular and ligamentous strain elsewhere. They share this feature likewise in common with them, that they have a tendency to last obstinately for a long time; to recur after intervals of comparative or entire ease; to be induced by changes in the weather, or by any extra exertion; and so, by their very nature, they unduly alarm the patient, and encourage him in the belief that his injuries have been greater than they really are, and that the prospect of his recovery, without permanent damage or disablement, is very remote indeed. It behooves us not to share in his alarm, but rather to use every influence to induce the patient to take those steps which alone can insure his recovery—to leave his bed, to have change of air, if need be, to improve his general health, and to allow of greater opportunities of movement than were he to stay at home. Be

careful, however, before all things, not to overlook any symptom which is a real indication of injury of the spinal membranes or of disease of the spinal cord.

Not for this reason only is it desirable to make a correct diagnosis as soon as possible, but also because there are few things worse for a patient, whether man or woman, than for the back to be constantly examined, and for pain and tenderness to be elicited over and over again at the injured parts. Repeated examination is the very way to develop a state of undue nervousness, and to bring about a hyperæsthesia of the surface which is often most distressing. Just as hyperæsthesia over a wide region of the skin of the hip may be seen in cases of so-called hysterical coxalgia, so a widely-diffused sensitiveness of the skin of the back may arise in many cases of simple sprain unassociated with other disease of the spinal column. Its onset and development may occasionally be observed, and its real origin be thus made manifest.

Case V.—*Sprain of the Dorsal and Lumbar Vertebræ—Great Surface Hyperæsthesia.*—A young man was slightly shaken in a collision of no great severity, and in a few days had pains about the vertebral column such as have been described. He gradually recovered from the effects of the shake, but the aching in the back continued, and the spine was therefore more especially examined, not much attention having been paid to it hitherto. The examination revealed a point of tenderness on pressure over one of the dorsal vertebræ, at the point in fact where the sprain had probably been most severe. Within a day or two his back became so sensitive that he complained of, and shrank from, the very lightest touch of the finger on almost every part of it, whether over the spinal column or over the muscles at the side. He was so sensitive to touch that he endeavored to avoid being touched at all, seemed even afraid to have his back looked at, and moved himself away with so much contortion, as in itself to afford evidence of the absence of any serious mischief about the vertebral column or its contents. The hyperæsthesia was doubtless perfectly genuine; but in addition to the mode of onset, observe the inconsistencies of the hyperæsthesia itself. So great was it, that had it been real and not imaginary, it must have been unbearable for the man either to have rested against his couch, or even to have borne the contact of his clothes.

This is the hyperæsthesia so often found superadded to the pain which is a real consequence of the vertebral sprain; and yet too frequently the inconsistencies thereof are ignored, and the hypersensitiveness is regarded as another, and more telling, symptom of some inflammatory condition of the membranes of the spinal cord. It has little in common, however, with the hyperæsthesia or the "eccentric" pains which are a result of irritation of the sensory nerve-roots, whether by thickening of membranes or otherwise; and it is unlike the zone, or girdle of hyperæsthesia, which may feel to the patient like a cord, or some other abnormal sensation at the periphery. The hyperæsthesia is too wide-spread over one area, and is at the same time too limited to the area which is the chief seat of attention. It is, moreover, unlikely that real irritation of the sensory nerve-roots should give rise to hyperæsthesia upon the back alone. It is rather the natural outcome of that alarm, which, both in hospital patients and in those more especially who have been in railway collisions, seems to be inseparable from injuries to the spine or back; and although undoubtedly a real condition to the patient himself, it is yet unreal, and the product of his disordered imagination alone.

It is hardly necessary to dwell upon the pain and local tenderness of which there is no sign when the attention of the patient is otherwise engaged and directed away from the affected part. These may be of the same nature as the hyperæsthesia, though much more often they have no real existence, and are heard from those persons only who are purposely exaggerating the effects of the injuries they have received. Let it be remembered that a far more important sign than variableness of the pain under examination, is the very fact that the attention of the patient can be so easily diverted from the affected part. Call to mind a case of severe inflammation of the knee-joint, and ask whether it is not well-nigh impossible to divert the patient's attention from his knee when being examined, and whether he does not guard it with all the more conscious care, because he is being asked questions wholly unconnected with the painful limb. The very readiness with which the attention can be diverted from the tender back is of greater diagnostic import than the spinal tenderness or pain.

The hyperæsthesia and tenderness just alluded to are of a nature akin to the tenderness which is observed in the cases of so-called "spinal irritation," a malady with which the brothers Griffin dealt very fully in 1834, in their interesting and well-known work, "On Functional Affections of the Spinal Cord." They there point out (p. 201) how spinal tenderness is a "common attendant on all hysterical complaints, on numerous cases of functional disorder where the hysteric disposition is not so obvious, and in many nervous or neuralgic affections." The tenderness might be both local and general over the spine, and in their judgment it was enough to throw doubt on any other symptom suggestive of intraspinal lesion or inflammation.

Passing, then, from the pain, tenderness, stiffness, and hyperæsthesia which are the more immediate signs of that kind of injury which the back most frequently receives in collisions, I proceed in the next place to speak of other symptoms or complaints which occasionally accompany them, and which may be regarded as evidence of damage to structures other than the bony, the ligamentous, and the muscular of the vertebral column.

And in the consideration of them it is necessary to bear in mind that however well the spine itself, and the muscles and ligaments which bind its various parts together, may be adapted for protecting the intraspinal structures from injury, even at their own expense, it is simply a question of the degree of the violence whether muscles and ligaments are alone injured by forces which tend to overbend the spine. Up to a certain point these soft structures may succeed in keeping safe the parts within, even though they themselves may suffer in the attempt; beyond that point their resistance is overcome, and there may, as a consequence, be separation of parts which it is their business to hold together. This is, of course, much more likely to happen when the violence has fallen upon one part, instead of being widely diffused, and a not uncommon way in which the cord may be locally damaged, is by overbending of the spine.

The pseudo-paralysis of muscular incapacity has already been described, but abnormal sensations of tingling and numbness, or of "pins and needles" in some parts of the limbs, are not very uncommon after severe collisions. (Abnormal

sensations described as "tingling" or "pins and needles" are, although purely subjective, much more trustworthy terms than "numbness," which the laity use with a signification wholly different from that in common use among ourselves. Dread of moving the limbs without causing pain, bodily weakness and stiffness from confinement to bed, or the sensations produced by general bruising of the limbs, may each and all be described as "numbness," even when we find, and the patient admits, that there is no real anæsthesia nor true loss of muscular or sensory power. Thus, for example, a man described his leg as feeling "numb" after having received a slight blow on the side of the knee.) All such complaints ought rightly to be regarded as worthy of attention and anxiety, especially if they last for any length of time after the accident, or if it can be definitely asserted that the spine alone received injury. It is rare, however, for the injuries received in severe collisions to be limited to a single blow on one part of the spinal column, and it is important to determine whether these abnormal peripheral sensations are not really due to some blow sustained by the limbs themselves, before deciding that they are the manifestation of central damage. When this obvious fallacy has been excluded, the remaining proportion of cases in which these complaints are made is found to be very small.

Case VI.—*Severe General Vertebral Sprain—Sensations of Numbness and Tingling.*—E. H. D., aged thirty-five, received in a severe collision "a blow," as he expressed it, "down his whole back," and also on the back of his head from a falling carpet-bag. He did not consider himself much hurt, although from the account of his appearance there must have been a considerable degree of shock. He proceeded on his journey, but three-quarters of an hour after the accident he felt compelled to stop and go to bed at a neighboring inn. He then began to suffer from severe pain in the head, and from pain down the whole of the spine, but more especially about the sacrum and the lower cervical region. There were no marks of bruising. He also complained of "numbness and tingling" in his limbs, with some difficulty in moving them. He suffered for three days from extreme nervous prostration; dreaded the least noise; spoke only in a whisper, and lay in a darkened

room. There was, however, no disturbance of pulse or temperature, and he had been able to sleep without narcotic for a few hours on the night after the accident. On the following days his limbs felt more natural, and the tingling and sensation of numbness had very much lessened. In five days these sensations had completely disappeared, but he still suffered from much pain about the vertebral column, and movements of the neck and trunk were painful to him. He was excessively nervous, and much dreaded any examination of his back. The pulse and temperature were throughout normal. He continued steadily to improve, and in three weeks was able to be moved. In three months he was going out daily, walking slowly about three miles a day, but complaining much—especially under examination—of pain in and about his vertebral column, the movements of which were evidently stiff and painful. He was still very nervous and felt generally weak, but there was no impairment of motion or of sensation in his limbs. He returned to work in about seven months. Five years after the accident he was at work and in good health, though often complaining of his back, "especially when lifting heavy weights."

It is obvious both from the history at the time and from the long-continued pain afterward, that there was here precisely the same kind of injury, as far as the spinal column was affected, as in the two previous cases, but with the important addition of some abnormal sensations in the limbs, coming on synchronously with the pains, and disappearing after a few days. These sensations were general, and were not confined to any one limb or part of a limb; and although it is impossible to define their cause with certainty, there are good grounds for believing them to be due to some effect produced by strain or blow upon the nerve trunks proceeding from the spinal column to the limbs. In severe collisions, where there is a risk of the body being suddenly bent and strained in many different directions, it is, indeed, highly probable that every part of the spinal column is subjected to muscular and ligamentous strain, and it is not inconceivable that the nerves which permeate the column at both sides should be involved in the same injury.

No one will dispute the wisdom of absolute rest in all such

cases, even though there is no warrant for thinking that the symptoms will be followed by some less dubious indication of central nerve lesion. In themselves they are rare, and found only after the more serious accidents in which there is a risk of extensive bruising and straining of the whole body. Whether the result of definite structural lesion or no, the symptoms of nerve disturbance leave no trace behind; in other words, recovery from the condition on which they depend is complete: and although the precaution of absolute rest is imperative, there is no evidence so far to show that they are of more serious import than is the sensation of tingling in the ulnar distribution after a blow upon the elbow.

Their presence, however, does not militate against the broad conclusion that the spinal cord is very securely protected from injury in its osseous canal, and that we shall probably find more definite symptoms when there has been undoubted lesion of the marrow itself. No matter what be the organ or structure, the severity of a lesion may differ vastly in degree, and it may perhaps be that these abnormal sensations are the symptoms of a disturbance which, in cases of more obvious local injury, amounts to actual damage—discoverable and giving rise to less transient symptoms—of the spinal cord or of the nerves proceeding from it.

The record, however, of a large number of injuries indisputably proves that the cases are few and far between, in which there has been unquestionable lesion either of central or more peripheral parts of the nervous system. Lesions of the spinal cord are met with only in a few isolated cases, and it is essential that this fact should be duly recognized if a right estimate is to be formed of the much larger class of cases, in which the injury and symptoms are rather those of general nervous shock, variable in degree, protracted in time, where it may be held by some that there has been concussion of the spinal cord, even though there has been no evidence of blow upon, or of damage to, the structure of any one organ or part of the body.

Case VII.—*Severe Lumbo-sacral Sprain—Probable Injury to Cords of Sacral Plexus.*—S. V., aged forty-eight, the mother of several children, gave the following account of the injuries she received in a severe collision which occurred at

night, and in which a great many persons were hurt. She had no distinct remembrance of what happened to her, but after she had been carried home and put to bed, marks of sevère bruising were found between the eyes, at the back of the head, on the chest, and more extensively about the lumbar and sacral regions of the vertebral column. Beyond the bruising there were no physical signs of injury to the spine. She was in bed for three months, suffering chiefly from pain in her back, so bad at first that she could not move in bed. She also had what she described as a "numbing pain down the left leg." At the end of three months she was so much better as to be able to get out, and shortly after to be moved to the seaside. Ten months after the accident her chief complaints were of pain in the back, especially on movement, and of a partial loss both of motion and sensation in the left leg. She was then using the leg as much as she could, though obliged to go about with crutches. There was very slight wasting of the limb, all the movements of which, it may be said, were sluggish and defective in power. There was diminution of ordinary sensation, slight only, but yet undoubted. There was no dragging of the limb in walking, the leg being rather held stiffly, and conveying the impression of injury having been received about the hip. There could, indeed, be no doubt that, in addition to the paresis, there was injury to the muscular and ligamentous structures about the hip and pelvis, injury which led to much of the stiffness about the thigh, such as might have been remedied by freer movement than the patient could give to it. There was never any paralysis of bladder or bowel. From the time when this patient was seen she steadily improved. Thirteen months after the accident she was able to abandon her crutches, though the report of her then was that "sensation is still very feeble in the injured leg, but there is still progress made." Two years later, or three years after the accident, this last report was sent by the surgeon under whose care she had continuously been: "The case you saw two years ago has resulted in a complete cure, and she is now able to walk about almost as well as ever."

It must, I think, be regarded as very highly probable that the impairment of motion and sensation in this case was due to some injury to the nerve trunks, but it is impossible to say

with certainty whether that injury was after the nerves had formed the plexuses outside the vertebral column, or when they still were individual cords in the cauda equina. If the paresis was due to traumatic lesion of the nerve trunks within the spinal canal, it is almost inconceivable that the effects could have been confined to the nerves of one limb only, and on this ground it seems more reasonable to conclude that the injury to the nerve trunks was outside the vertebral column. The length of time, moreover, that elapsed before the recovery of the patient, seems further to confirm this opinion, whether the essential lesion was of the nerves themselves, or, as is equally probable from the character of the blow, was hemorrhage lying around and pressing upon them.

Case VIII.—*Lumbo-sacral Sprain—Probable Injury to, or Hemorrhage round, Pelvic Plexuses.*—A strong and healthy man, aged twenty-nine, was thrown down on the floor of the carriage in a sharp collision, and knew that he had had a severe blow over the right sacro-iliac region. He almost directly afterward had sensations of pins and needles all over him. These soon passed away, but he was in bed more or less for four months, suffering from great pain in the lower part of the back, and numbness and heaviness in his legs. For three months his pulse was as slow as fifty-six. Eight months after the accident he was still quite unable to attend to his work, and suffered at times very much from pain in the back and from weakness in the legs. This weakness more especially involved the right leg, and although every required movement could be performed, it was evidently done with difficulty, and there was some impairment of common cutaneous sensation. There was no wasting, and the reflexes were normal. His gait was distinctly suggestive of lumbar stiffness, and there was clearly in addition some defect in the innervation of his right leg; and five years after the accident, although he was well and at his work, there was still said to be pain about the sacrum and right hip, made worse by walking or long standing, and the right leg was described as being not as large as the other. This statement, however, there was no opportunity of confirming by a medical examination, and it must remain a matter of doubt whether any and what injury had been incurred by the pelvic plexuses.

It is never easy, in cases like these, to separate the symptoms which are due to interrupted or damaged nerve function from those which depend on muscular, ligamentous, and osseous bruise and strain. These last may be very severe, and may give rise to great mechanical impairment of motor power, producing the pseudo-palsy to which earlier reference has been made; and only a very careful examination of the limb, and of all the attendant symptoms, will enable one to decide that there has or has not been injury to nerve structures. In the great majority of these cases of general lumbo-sacral strain, they usually escape direct injury; but there is no question that this form of traumatic lumbago, due to violent wrench of all the ligamentous structures of the ilium, sacrum, and lower spine, of all others is the most painful and the most incapacitating, and the pain is very prone indeed to radiate widely from the part where it has its original seat. It is by no means uncommon, in cases of ordinary lumbago, for the pain to spread to the lower abdomen, to the testes, and down the legs, but there is no reason to think that the pain which radiates in this way, whether in simple or in traumatic lumbago, is due to any gross lesion in nervous structures. Help in diagnosis will always be had by learning the character of the blow which has been received in the collision, or the precise mode in which injury has been inflicted upon the back. My own inquiries and experience leave no doubt in my mind that any local lesion of nerve centres, or of nerve truks, has its origin in injury at or close to the part, and that the general concussion of the accident is inadequate to bring about so grave a result. The cases already given exemplify this, but not so markedly as the following.

Case IX.—*Late Myelitis following Obscure Spinal Injury.*—T. L., aged twenty-nine, a thin, delicate man, was in a very bad collision in which three persons were killed, and in which a large number were injured. He could give no clear account of the accident, saying he was dazed and could not stand. He was confined to bed for about a fortnight, suffering much from pain in his back and legs. He then improved a little, and was able to go to a hydropathic establishment in the country, where he stayed for two months. His back continued to trouble him very much (this is in his own words),

but otherwise he improved. Toward the close of these two months the weakness which he had all along felt in his legs became a much more definite loss of power, and in a week or ten days he was quite unable to walk. Ten months after the accident there was no mistake as to his condition. Loss of power to move, and almost entire loss of sensation in his legs, paralysis of bowel, paralysis of bladder with alkaline urine, bed sores, and reflex spasms of the lower limbs, undoubtedly pointed to softening of the spinal cord. His pulse was frequent, and his temperature above normal. He complained of pain in the lower part of the back, but there was no marked tenderness. He lingered for some months without improvement, and then died.

It is unfortunate that no post-mortem examination was allowed in this case, for it would have been in every way desirable to have learned exactly the nature of the injury, if any, which the vertebral column sustained, and how it came to pass that the cord became affected. The precise train of events can therefore be a matter of conjecture only. Two months elapsed between the receipt of the injury and the onset of definite symptoms of inflammation and softening of the spinal cord itself, and there is unfortunately no more accurate record of what his condition really was during this period. The mode in which he was injured, however, seems to render it not improbable that there were symptoms which should have made a fortnight's stay in bed altogether inadequate, and so early a move to the country most unwise. For the accident really happened in this way, as was learned from another person who was with him at the time. The patient was thrown on his face on the floor of the carriage, and a very "heavy man then fell on the top of him, right in the middle of his back." There was thus no doubtful history of a blow, of obscure injury to a remote part, or of a general shake of the whole body, but a clear account of an accident so happening, that, without any visible signs of damage to the spine, there may well have been some separation of vertebræ, or some undue bending of the column, which, damaging at the same time the membranes of the cord, or causing slight intraspinal hemorrhage, was the real starting-point of the mischief which supervened.

I would suggest the following as a very probable sequence of events: A small localized injury of the membranes, or hemorrhage, at the site of the injury to the vertebral column, followed by a meningitis which was at first too limited in extent to give rise to any precise symptoms, but which preceded, and, having implicated the cord, was the cause of the myelitis which had a fatal issue. If this be the explanation, the meningitis must have at first been exceedingly limited, because traumatic meningitis does not usually follow an unobserved course. Sometimes it is acute, spreads rapidly, gives rise to definite symptoms, and has a fatal result. At other times a less violent inflammation leads to local thickening and adhesion about the spinal roots, causing peripheral symptoms of impaired innervation; or similar pathological changes may involve the cord itself, and setting up degeneration therein, present very definite indications of structural disease. But acute myelitis at so long an interval after injury is most uncommon. Still further doubt, however, surrounds this case, for at the time when the symptoms of spinal softening were becoming marked, the man had epididymitis. It is true that gonorrhœa was altogether denied, and that the epididymitis may have been caused by the frequent use of the catheter; but it is to be remembered that myelitis of the cord may be the result of thrombosis of the pelvic and vesical veins, a direct consequence of the same urethral inflammation which had produced epididymitis. It seems, therefore, within the range of possibility that the myelitis and the fatal result were not due to the injury at all.

I have seen no case of acute traumatic meningitis following railway injury, nor any in which I could satisfy myself of the presence of subacute or chronic meningitis as the basis of the symptoms of general nervous shock which are frequently seen after railway collision, and which will be described in a coming chapter. I have often heard "subacute meningitis" put forward as the cause of the localized pains in the back which are common after sprains of the vertebral column, more especially when such pains have been associated with general bodily weakness due to long confinement in bed or in the house, and with the nervousness and emotional disturbance which are inseparable from severe shock to the system. The history and course of the cases, however, and the entire ab-

sence of the real symptoms to which meningitis gives rise, have convinced me that no such serious mischief could exist. For meningitis of the spinal membranes is a serious organic lesion, and it is hard to believe that if subacute meningitis of traumatic origin were as common as some would seem to believe it to be after collisions, we should not much more frequently meet with cases of meningitis running an acute course, or with cases where there is likewise degeneration of the spinal cord.

Injuries to the cervical spine are, for obvious reasons—its lesser strength and its greater mobility—more likely to be followed by local meningitis than are injuries to the lower parts of the column; but wherever the lesion be, it should never be forgotten how frequently syphilis has a share in keeping up any chronic inflammation of the membranes of the spinal cord. (See paper by Dr. Buzzard on "Cases of Syphilitic Paraplegia," "Lancet," Vol. I., 1879, p. 469. After detailing a case of paraplegia, with strangely variegated symptoms, cured by anti-syphilitic remedies, he writes: "With the clear history of syphilis before us, we can well imagine that the meningitis was gummatous, and that it probably involved especially the internal surface of the dura mater (pachymeningitis), but extended also to the contiguous soft membranes. . . . Note, also, that there was no tenderness on percussing the vertebral spines. The absence of this symptom is too often regarded as being almost inconsistent with the existence of serious lesion of the cord or its coverings. Nothing can well be less founded in fact. If we put aside cases in which the vertebral column itself is diseased, we shall find that the existence of very marked spinal tenderness points strongly in the direction of a functional nervous affection of comparatively little importance, and does not indicate a serious organic lesion of the spinal cord.") In a case under my own observation not long ago, the symptoms of a scattered meningitis—to wit, slight wasting and partial loss of motion and sensation in the legs—had been attributed to an injury to the spine: but as a matter of fact there was a very distinct history of syphilis, the symptoms had more than once been lessened and almost removed by the administration of anti-syphilitic remedies, and careful inquiry proved that the supposed injury was altogether trivial. And although, from a medico-legal point of

view, the presence of a syphilitic taint does not debar the patient from compensation for injuries received, such taint must of necessity be acknowledged if we are to form a correct estimate of the probabilities of recovery in any particular case. ("Inasmuch," says Dr. Ross [Diseases of the Nervous System, 2d ed., Vol. I., p. 293], "as there is no severe organic disease affecting the nervous system in which the results of treatment are so often satisfactory, so there is no disease which deservedly brings so much discredit upon the practitioner who overlooks its presence.")

Happily there is no doubt of the exceeding rarity of spinal meningitis as an immediate result of localized injury to the vertebral column. The same remark applies with especial force to the results of the injuries which have been considered in the early part of this chapter; and I know of no case in which meningeal inflammation has been caused by injury to some part of the body remote from the spine.

While then the victims of railway collision are not by any means exempted from liability to suffer from any and every form of lesion of the spinal cord and its membranous coverings, accumulated experience leaves no longer any doubt that these grave results are most uncommon, and that though the back is especially prone to suffer injury in this form of accident, it is the extra-spinal structures which, in ninety-nine cases out of a hundred, bear the brunt of the violence and suffer from it. Such is the immediate consequence, but in every medico-legal inquiry the future as well as the present has to be considered. What is the prognosis; and what risk is there after the receipt of some such obscure injury of the back as we have been dealing with, there shall supervene, as a consequence of the injury, the symptoms of degeneration of the spinal cord? No more vital question can be asked in treating of railway injuries. It has from the first engaged my very careful attention, and I have endeavored to learn of cases where there has been degeneration of the spinal cord as a remote consequence of spinal injury. My inquiries have either been singularly unsuccessful—and they have been made by direct oral and written communication with many professional brethren in all parts of the country—or it must be admitted that secondary and remote degeneration of the spinal cord, in cases where there has been no distinctive evidence of injury,

is very rare indeed. Nor have I been able to discover any grounds for thinking that the injured in railway collisions, numbering many thousands since the first accident happened, have afforded a larger proportion of those degenerative system-diseases of the spinal cord, which in recent years have so much engaged the attention of neurologists and pathologists, than have those persons who have not been exposed to the same influences. It is perfectly true that in some recorded cases the onset of a system-disease has had no more obvious cause than injury and there is nothing inherently improbable in such a sequence of events; but cases of the kind are wholly exceptional, and are too few in number to call for the introduction of any account of them in a chapter devoted only to the common and everyday forms of spinal injury as seen after collision accidents.

A survey has thus far been taken of the common spinal injuries of railway collisions, but there is nothing in all that has been said to suggest that these injuries differ in any way from spinal injuries received in other forms of accident. Their frequency is, however, unquestionable; and this, as we have seen, is due to the special nature of railway collisions, whereby the back is very liable to be sprained. Given a case in which a mere sprain of the back is the only injury sustained, there is not, and there ought not to be, much difficulty in diagnosis; but again, the nature of a railway collision determines a liability to other forms of health disturbance, which, in company with a spinal sprain, may make the diagnosis far from easy, and may be the source of needless alarm. Here step in to perplex the clinical inquirer those so-called functional, emotional, and hysterical disorders, which have yet to be considered, which are really due to the fright and mental shock incidental to railway accidents, but which have been too often looked upon as the result of injury to the spinal membranes or the spinal cord. Here also in very common association are the symptoms due to severe general nervous shock, which are seen even when there has been no evidence of injury to any one organ of the body, or of a blow, having been inflicted on any single part. They may come on soon after the accident, or be delayed for many hours; they are characterized by enfeebled function both of body and mind, and are not

uncommon in those who have received no bodily injury whatever. As I shall have to point out, they are the continued expression of severe nervous exhaustion. Picture a case of this kind, and add to it sprain of the muscles and ligaments of the vertebral column with the resultant pain on movement, so obstinate in its duration, and the tenderness—sometimes acute—on touch, and it is neither more nor less than natural —though a natural mistake—that the whole condition should be attributed to some alteration or morbid change of the spine and spinal cord which have been concussed.

The jar or vibration of a collision must doubtless shake the spinal cord as much as the brain and every other organ of the body, but there is scant reason for an explanation of the symptoms of general nervous shock in degenerative changes of the structures lying within the spinal canal, simply because the patient has a painful, stiff, and tender back. However alarming such cases may be, the tendency is toward perfect recovery after a longer or a shorter time. And, inconsistent though it may at first sight appear that anything apart from the injury and the bodily condition itself should influence convalescence, it is none the less a fact, which daily experience confirms, that the period of recovery very frequently begins at the moment when all mental anxiety and worry are at an end as to the legal aspects of the case. The settlement of the patient's claim for compensation has a potent influence in bringing about convalescence, not necessarily because there has been imposture or a lack of perfect genuineness in the facts and features of the case, but because, as a very symptom of the malady itself, there must have been an inability to bear the strain of a medico-legal inquiry. The strain removed, the anxiety lessened, there is nothing now in the way of a hopeful effort being made to return to a more natural and healthful mode of life, and each returning day of improved mental tone forges one more link in the chain of progress toward recovery. I am not referring here, be it remembered, to cases which are not strictly genuine, and where there is grave reason for suspecting the *bona fides* of the patient. Examples of this kind are not uncommon, where the prospect of larger pecuniary gain acts as a temptation to keep up the invalid state; but we must be careful that the absence of objective signs of nerve

lesion does not lead us into the error of throwing doubt on the integrity and veracity of those who are really suffering from the symptoms of general nervous shock. There is a vast difference, however, between the false and the true, and the one can be distinguished from the other without much difficulty.

CHAPTER II.

GENERAL NERVOUS SHOCK.

HAVING thus far given an account of the injuries of the back which are commonly met with after railway collisions, my next duty is to turn to the cases vastly more numerous, and even more important, to which I have already referred under the name "general nervous shock." This term is applicable rather to the whole clinical circumstances of the case than to any one symptom which may be presented by the injured person. It is a phrase which, in its very lack of precision, appears suitable to describe the class of cases which we must now consider; for we shall see that the course, history, and general symptoms indicate some functional or dynamic disturbance of the nervous equilibrium or tone, rather than structural damage to any organ of the body.

We are all familiar with the term "shock" as synonymous with the collapse which accompanies all profound and sudden injuries, whether inflicted upon the head or upon some other part of the body. And this collapse or shock we are wont to regard as the immediate expression of lowered, or annihilated, function of the great nerve centres which preside over the vascular system; paresis of the heart and of the peripheral parts of the circulation being the essential factor in inducing the pallor and coldness which affect the whole surface of the body, and the mental enfeeblement which is due to impaired flow of blood within the brain.

This, however, is not the place to enter into any lengthened description of the nature of true shock or collapse. (Mr. Savory's article in Holmes' System is known to every one, and in Groeningen's "Ueber den Shock" will be found a full account of all the symptoms and of every theory upon it.) No matter how the injury may have been inflicted, provided only it has been sudden and severe, whether by railway accident or by the more ordinary casualties of everyday life, shock or

collapse in greater or lesser degree is invariably recognized as one of the features of the patient's general condition immediately after the injury has been received. The collapse may be lasting and profound, or it may be slight and transient, but in every case it is an immediate consequence of the injury, which, by its suddenness and severity, has induced the paresis which primarily affects the great central organ of the circulation. Nor need any description be given of the history and symptoms of cases of shock or collapse, with which all are doubtless familiar in hospital practice. There is, in fact, no condition which is more obvious or more striking than that of the seeming lifelessness, which is an indication that some severe impression has been made by injury upon the nervous system.

The term "lifelessness" is indeed an appropriate one to give to the state of shock from injury in its more serious degrees. There is a lowering of the vitality of every organ and function of the body, from mental activity and capacity to that of the least important function in the animal economy. And that which probably lies at the very foundation of many of the symptoms of shock or collapse is temporary paresis of the heart, and of the whole circulatory system. The slow, feeble, or almost annihilated pulse, the pallor of the lips and coldness of the extremities, the mental hebetude, the anæsthesia of the surface, the relaxation of the sphincters, the lessened secretion of the urine, the impaired muscular action, each and all are dependent in varying degrees on the paresis of the heart and vascular system, and on the impression upon the whole nervous system of which that is the first and most immediate result.

The collapse may be so profound as to be a source of greater danger to the patient than the bodily injury which he has sustained. The issue may be rapidly fatal, although death is the exceptional rather than the usual result of uncomplicated shock. The heart, under the appropriate treatment of quietude and warmth—masterly inactivity—or if need be, of stimulants—alcohol, strychnine, and digitalis—regains its normal power, and the functions are once more naturally performed. The collapse is frequently succeeded by a period of "reaction," in which the temperature and pulse are slightly raised until the equilibrium of health has been established;

but whether there be reaction or no, the symptoms pass away, and except as an indication for treatment, as a rule, they give us little more concern. Patient and surgeon are far more interested, after the subsidence of the initial collapse and its incidental risks, in the successful issue of the needful operation, or in the usefulness restored to the limb or organ which has been damaged. If these results be satisfactory, the patient leaves the hospital gratified at the recovery which he has made, and thankful, perhaps, that his injuries were not more severe. What has become of the collapse which on his admission into hospital was a striking feature in his case? Has it on after-symptoms, or has it, as we thought it had, completely passed away? Important questions these; but as a matter of fact we know so little of the after-history of hospital patients, that from their cases we can draw but little help in elucidation of the general nervous shock which is met with after railway collisions, and whose after-symptoms may perhaps be far more prominent than those which immediately followed the injury. Our hospital patients, as we believe, recover, and rarely or never do we hear of the symptoms, nor do we meet with the class of cases to which I shall direct attention now.

Surgeons are pretty well agreed that the collapse in cases of accident brought into hospital is usually very profound after the injuries—crush of limbs, for example—which railway servants meet with at their work, and which often call for operative interference. Compare two cases of like injury, the one received by accident on a railway, and the other by being knocked down and run over in the street, and there is great probability that the manifestations of shock will be much more marked in the former case than in the latter. The difference I believe is this, that in the one case there is an element of great fear and alarm, which has perhaps been altogether absent from the less formidable and less terrible mode of accident. How largely fright may of itself conduce to the condition recognized as shock is well shown by a case communicated to me by a surgeon of large experience, who, summoned to a railway station to see and conduct to the hospital a railway servant who had had his foot, as was supposed, run over on the line, found him in a state of collapse, and in greatest alarm as to the injury to his limb. Upon examination it

was discovered that the only damage was the dexterous removal of the heel of his boot by the wheel of a passing engine. And medical literature abounds with cases where the gravest disturbances of function, and even death or the annihilation of function, have been produced by fright and by fright alone.

It is this element of fear, this great mental shock which in railway collisions has so large a share—in many cases the only share—in inducing immediate collapse, and in giving rise to those after-symptoms which may be almost as serious as, and are certainly far more troublesome than, those which we meet with shortly after the accident has occurred. The reasons for this are not far to seek. The incidents indeed of almost every railway collision are quite sufficient—even if no bodily injury is inflicted—to produce a very serious effect upon the mind, and to be the means of bringing about a state of collapse from fright, and from fright only. The suddenness of the accident, which comes without warning, or with a warning which only reveals the utter helplessness of the traveller, the loud noise, the hopeless confusion, the cries of those who are injured; these in themselves, and more especially if they occur at night or in the dark, are surely adequate to produce a profound impression upon the nervous system, and, even if they caused no marked shock or collapse at the time, to induce a series of nervous disturbances at no distant date. "The principal feature in railway injuries," says Mr. Furneaux Jordan, "is the combination of the psychical and corporeal elements in the causation of shock, in such a manner that the former or psychical element is always present in its most intense and violent form. The incidents of a railway accident contribute to form a combination of the most terrible circumstances which it is possible for the mind to conceive. The vastness of the destructive forces, the magnitude of the results, the imminent danger to the lives of numbers of human beings, and the hopelessness of escape from the danger, give rise to emotions which in themselves are quite sufficient to produce shock, or even death itself. . . . All that the most powerful impression on the nervous system can effect, is effected in a railway accident, and this quite irrespectively of the extent or importance of the bodily injury." ("Surgical Enquiries," 2d edit., p. 37.)

In these purely psychical causes lies, I believe, the explana-

tion of the remarkable fact that after railway collisions the symptoms of general nervous shock are so common, and sometime so severe, in those who have received no bodily injury, or who have presented little sign of collapse at the time of the accident. The collapse from severe bodily injury is coincident with the injury itself, or with the immediate results of it, but when the shock is produced by purely mental causes the manifestations thereof may be both prolonged and delayed. Warded off in the first place by the excitement of the scene, the shock is gathering, in the very delay itself, new force from the fact that the sources of alarm are continuous, that they may recur for days, and for a time be all potent for evil in the patient's mind. "In certain temperaments, wrought into a state of extreme excitement, a comparatively severe injury may not be attended with that degree of shock which, under other circumstances, would be seen. In those cases, however, shock is usually deferred, and not altogether averted; and it may be all the more severe, seeing that reactionary mental exhaustion, itself a kind of shock, is superadded to the effects of bodily injury." (Furneaux Jordan, op. cit., p. 27.)

Due weight must, therefore, be given to alarm and profound mental emotion as causes of the symptoms of general nervous shock so frequently seen after railway collisions. Sufficient importance, indeed, has not been attached to them, and many errors in diagnosis have been made, because fright has not been deemed of itself sufficient to bring about the train of symptoms which will be described. On the one hand, we may hear the condition regarded as evidence of serious and irremediable pathological change in the chief centres of the nervous system; and on the other hand, no clear history of pronounced shock or collapse at the time of the injury being forthcoming, the symptoms are deemed unreal, and the *bona fides* of the patient is called in question. The mistakes are at opposite ends, and I hardly know which is the worse for the patient, who, really suffering and ill, lies in the condition in which we find him because his whole nervous system has received a shock, not so much from severe bodily injury which shows itself in unmistakable signs, as from the impalpable element of alarm, which has to be measured by the events of the accident itself, and by the temperament of the individual who has been affected thereby.

The indications of collapse at the time of accident are very variable. The profoundest grades are occasionally seen after the worst accidents, where there has been in all probability destruction of life and limb. In these circumstances it is no marvel that we should meet with examples of most alarming collapse, associated with definite structural injury, an injury such as would be commonly marked by collapse, however and wherever it had been received. The collapse, however, which in these railway accidents accompanies serious bodily injury, such as laceration of limb or fracture of bones—always excepting the collapse from severe concussion of the brain—is very rarely followed by the train of after-symptoms indicative of general nervous shock. This is a fact of great interest and importance, which will help to throw light upon those symptoms of general nervous shock which are often seen after the slighter degrees of initial collapse.

More numerous than the cases of profound immediate collapse are those where the accident has been less severe in its effects upon life and limb, and where the earliest signs of shock have been comparatively slight. "I was thrown forward and backward in the carriage; I felt myself shaken, but did not think I had been much hurt; I got out of the carriage, and was able to help some of the other passengers, and I came on home by the next train." Such is perhaps the simple story of the man who finds himself in a few hours, it may be only after two or three days, compelled to take to his bed because he feels so unnerved, and shaken, and ill. You make inquiry as to the more immediate effects of the accident upon him, and you perhaps learn that he felt shaken and was obliged to have some brandy, that he felt sick and faint for a few moments, or that he even vomited. He thought little of it, however, and gave help to others. A few hours elapse, and he finds he cannot sleep; he has aches and pains in various parts of the body, most likely in the back; he feels as if he had been beaten all over; he is thirsty, feverish, and ill; and, gathering fresh alarm from the very fact that he thought he had happily escaped all injury, he sends for his doctor, who sees that the symptoms of nervous disturbance and prostration have already begun. The prominent symptoms, however, do not always arise so soon. Conscious that he has sustained no bodily injury, the man continues at his work, and days go by before

it is brought home to him that he is not ready or active at his business, that he is soon tired, and has to leave off and lie down in the middle of the day. It is an increasing worry and annoyance to him to write his letters, or to talk with people on business affairs; the back of his head feels heavy, and his appetite deserts him. Nevertheless he struggles on, each day not feeling quite as well as on the day before, until at last the necessity is forced upon him of completely abstaining from his work. With varied modifications in detail, such stories as these are often heard of the effects which an accident has had on numbers of persons. It is clear, from what happened at the time, and from the early symptoms of reaction afterward, that there was undoubted shock immediately after, or within a short time of, the accident. Its early manifestations were slight, and were disregarded as little more than a feeling of faintness or of being dazed, but it was enough to show that the alarm of the accident produced an instantaneous or early result, and to be the starting-point of that disturbance of the nervous system which may assume an aggravated form, and continue for a very long time. It will be one aim of this work to explain how it is that the after-results of even very trifling initial shock from railway accident are often more lasting and serious, than are the later nervous symptoms of those in whom the early collapse, with extensive bodily injury, was originally more profound.

Lastly, at the other end of the scale are the cases where there is no evidence whatever of injury or of collapse, no faintness, nausea, or vomiting, no early reaction from an initial stage of depression, but where the after-history very closely simulates that of the more numerous cases which fall under our care. These I shall consider by-and-by, for few are commoner than cases of spurious nervous shock.

Let me now illustrate the kinds of symptoms with which we have to deal.

Case X.—*Severe General Nervous Shock—Prolonged Symptoms—Physical Injuries Slight.*—S.W., aged forty-six, a tall, somewhat powerful man, was in a very severe and destructive collision. He received bruises over both arms and legs, and also a blow upon the face which abraded the skin over, and fractured the bones of, his nose. He was not stunned.

He lay for several days after the accident in a state of great nervous depression, with feeble and rapid pulse, and inability to eat or sleep. He suffered at the same time much distress from the fact that a friend sitting beside him in the carriage had been killed; and this seemed to prey constantly upon his mind. The bodily injuries proceeded rapidly toward recovery, and in seventeen days after the accident he was able to be moved home. Nine weeks after the accident he had fairly well recovered from his local injuries, and made no complaint of bodily sufferings. Examination at this date discovered no structural disease, but he was evidently in a most feeble and wretched state. The ordinary functions of the body were natural, but his mental condition showed extreme emotional disturbance. He complained that he had suffered continuously from depression of spirits, as if some great trouble were impending. "He is easily upset and prone to cry. He says he used to cry whenever he spoke to any one, but that now he has rather more control. He has been out of doors for a few yards, but was stopped by a sudden sensation as if his breathing were very short. His voice is very weak and indistinct, and occasionally he says it is almost inaudible. There is no disease of the larynx or adjoining parts. He sleeps very badly, waking frequently, and being constantly troubled by distressing dreams. His pulse is weak, 104. He occupies himself by a little reading, and by occasionally going out, but he feels so shaken and weak that he is unable to do anything more. In many respects, however, he is improving. The weight he lost is being regained. He can walk rather further, is not so ready to cry, and his voice is stronger." He remained in much the same condition for several months, though with undoubted tendency toward improvement. Fifteen months after the accident, several months, that is, after his claim had been settled, I learned that he was better, though yet very far from right, and he was considered wholly unfit for work. His history, given four years after the accident by his medical attendant, is as follows: "In my opinion he will never be anything like the same man again. His appearance is much altered. He looks much older, haggard, and has become very bald. His voice is very weak, almost gone at times. For some time he went about in search of health, but improved very slowly, if at all. Lately he has obtained two posts, the

work at which is of a very light nature. I just jotted down the following symptoms as he mentioned them, and I feel sure he would not wilfully exaggerate them. Very depressed spirits, sometimes palpitation, loss of sleep, bad dreams, very easily tired, can't walk more than two miles, then gets very tired and quite loses his voice. Did nothing for two years after the accident. Has lost all his energy. Sometimes has a great dread of impending evil. He can travel by railway without feeling nervous, but can't drive without feeling frightened all the time. I may add that his heart sounds are rather feeble, but not otherwise abnormal. Pulse 72. No special spinal symptoms; no paralysis; no bladder symptoms; always gets much upset if dining in company or if many people are talking near him. I knew him well before the accident, and he was a very energetic and very honorable man." Three years later his symptoms were still subsiding. Since he began regular work he had continued more markedly to improve.

It must be pretty obvious from his history, that this man's prolonged illness was due in only small measure to the bodily injuries which he received. From these injuries, indeed, he had recovered, as soon as if they had been inflicted in any other accident and in any other way. The cause of his illness and of his altered condition, even after the lapse of several years, was the mental shock, call it fright or what we may, which the whole circumstances of the accident wrought upon him. There is no reason, in such a case, to believe that the condition is due to any gross pathological change, such as the unaided eye might see upon the post-mortem table, and certainly there is not meningo-myelitis of the brain and spinal cord.

Evidences of the immediate effects of fright alone are, of course, not often obtainable. In the following case, however, it was recorded in the official report of the accident that "a man, name unknown, was so frightened, and trembled so bad, that he had to be detained all night."

Case XI.—*General Nervous Shock—Great Fright.*—B. J., aged forty-four, a thick-set, somewhat robust-looking man, was in a carriage which ran off the line when the train had just left a station, and which, after jolting along off the rails

for a few yards, was turned over on its side. He says he was far more shaken, "terribly shaken" was his phrase, by the previous jolting than by the overthrowing of the carriage; and when he had got out, his condition was that mentioned in the official report. On the following day he travelled home alone, presenting on arrival so dazed an appearance that his doctor was immediately sent for. Ten days afterward he was suffering from muscular pains, increased by movement, in various parts of the body, and due, no doubt, either to bruising or straining when the carriage had been jolted and overturned. "He can hardly get any sleep, having before his mind a constant fear of the railway accident, and he becomes occasionally 'light-headed' at night. He is lying in bed with his eyes closed and the blinds down, complaining that he dreads the light. He gets very low-spirited, and frets about his business, the thought of which pains his head. He is much alarmed at the pains which he suffers, says he is afraid to move on account of them, and that he fears he has received internal injury. The bowels are confined. His temperature is 99° F., and his pulse is 102." Notwithstanding his expressions of fear, he was able to sit up in bed without sign of suffering, and in talking he moved his head naturally from side to side. He very soon also seemed quite content to have the blind drawn up, and gradually opened his eyes. There was no evidence of his having received any bodily injury other than muscular bruising and strain, and his condition was regarded by all who saw him as essentially one of general nervous shock likely to pass away after a time. When seen again at the end of two months, he had a somewhat worn and anxious expression, but said he was better, his "nervousness" being not so great as it was. "He complains of being easily upset and startled, and that the least excitement brings on a sharp pain in the head. The muscular pains are better, that which still troubles him most being a pain in the muscles of the left side of the neck. He sleeps better, though he occasionally has disturbed nights. He could walk two or three miles perhaps, but would be very fatigued. His pulse is 100." He had evidently much improved, and it was advised that after further change he should begin his work. Several weeks more elapsed, and I then found him neither looking nor feeling as well as before. He was very nervous about himself, felt

unable to do his work, was depressed and melancholy, and losing heart from the thought that he would never get well. He had been attending to his business for two or three hours a day, and the anxieties of it were very distressing to him. He was, moreover, very anxious to arrange his pecuniary claim for compensation, as both he and his doctors felt that that was now beginning to prey upon his mind. In bodily health he seemed well. Eighteen months after his claim was settled, I again had the opportunity of seeing him. He was then in perfect bodily health, able to follow his occupation as usual, and to endure as much physical exertion without fatigue as before the accident. He could not, however, remain as long at his desk without feeling worried, and his wife said that he was more irritable than he used to be. In these respects, nevertheless, he was admittedly improving, and he himself felt confident that before long he would be absolutely well.

Case XII.—*Slight General Nervous Shock.*—A case of lesser severity is the following: M. F., aged forty-four, a man, to use his own expression, of "excitable temperament," was in a sharp collision which the whistling of the engine had warned him was going to happen. He had thus been able to prepare himself for the crash. He was conscious of having a blow on the back of the neck. He did not, however, think that he had been hurt, and was able at once to help the other passengers. This work over, he walked a mile to catch a train at another station, finished his journey, and completed the business which had called him away from home. On the following day he felt "queer," and sent for his doctor, who found him agitated and depressed, unable to occupy himself, and complaining that he felt shaken. His pulse was, however, natural, and his temperature normal. He subsequently suffered from sleeplessness, and he had pains in various parts of the spinal column, where it was supposed he had been sprained or bruised. There was never any evident disturbance of the organic functions, but for some months he suffered from sleeplessness, from much depression of mind, from inability to occupy himself, and from a constant sense of weariness in the small of the back. After change of air he found himself better, and then complaining that want of work was distressing to him, he attempted to resume his business, but found that it made him worse, more nervous and depressed, and more sleepless at night. Further

change of air, however, did him good, and in nine months he arranged his claim. In twelve months he was again at his ordinary work, having "entirely recovered" from his illness. He continued at his business for some years afterward, and then retired.

Case XIII.—*Neurasthenia Induced by Fright—Previous Anæmia.*—A lady, aged twenty-four, was in a collision which took place at night without the slightest warning. The luggage fell all about the carriage, and her husband was thrown against her, but she herself was neither moved from her seat nor injured on any single part. As soon as she got out she was much alarmed at seeing a carriage had been smashed to pieces, and then she watched a man being rescued from the débris in which he was buried. She went on her journey, and the next day felt, to use her own words, as if she had passed through something terrible, and from that time onward she became sleepless, lost her appetite and strength, suffered from pain in the back of her head and at several spots down her spine, and was quite upset by any attempts at household work, or by reading and writing. Thinking she had not been hurt, her friends urged her to do as much as possible and not to give way, but she steadily got worse rather than better, and although not in the least hysterical, it was not until proper treatment was begun that improvement set in. The case was complicated by previous dysmenorrhœa and anæmia, both of which were increased for a time by the accident.

These examples give a good idea of the history and class of symptoms which cases of general nervous shock usually present. They were all of them, I believe, free from the taint of conscious exaggeration or imposture, but it must be abundantly obvious how largely the reality of many of the symptoms, lacking all vestige of objective sign, depends upon the veracity and good faith of the patients themselves. On this account it is that the cases are so difficult to describe, and that it is almost impossible to convey an adequate impression of them to those who may have never seen them. I propose, therefore, to bring together and to say something about each of the various symptoms which are commonly met with, or of which the patients complain, when suffering from "general nervous shock." And here it may be well to premise that I

draw a broad distinction between the condition to which this name is given and that in which genuine hysteria is a pronounced symptom. General nervous shock is not hysteria. It is frequently met with in those who show no hysterical disturbance whatever, as likewise there may be much hysteria without any symptoms of general nervous shock.

Nevertheless, while I see much to agree with, and that I cannot improve upon, in Mr. Thorburn's tentative classification of the post-traumatic functional neuroses ("A Contribution to the Surgery of the Spinal Cord," p. 186. Griffin & Co. 1889)—

"1. Acute effects.

"(*a.*) General nervous depression—'shock' or 'collapse.'

"(*b.*) A more localized and defined disturbance of cerebral (cortical) origin—'acute hysteria' or 'hysterics.'

"2. Chronic after-effects.

"(*a.*) General nervous depression—'neurasthenia.'

"(*b.*) A more localized and defined disturbance of cerebral (cortical) origin—'chronic hysteria'"—

it is by no means uncommon in my experience for the two states—hysteria and neurasthenia—to be associated together. Both are originated by the same cause, but the symptoms due to each can usually be determined. Should there be any tenddency to hysteria, the state of general nervous depression is clearly one likely to develop and maintain the purely hysterical disorder, and it is frequently obvious that the hysterical disturbance protracts the symptoms which are really dependent on the general nervous exhaustion. To cure the one is very often the best and only means of removing the other.

Thorburn writes: "The symptoms of neurasthenia arise from a general defect in the nutrition and action of the nervous system. . . . The symptoms follow those of shock, and are the expression of an exhausted nervous system. They are generally transient, and will pass away under conditions and a line of treatment which may be briefly described as 'tonic.'" (Op. cit., p. 185.) Neurasthenia—to use the word now commonly given to the aggregate of symptoms of an exhausted nervous system—is, in my own experience, very much more common than hysteria. It is characterized by some or all, in varying proportion and degree, of the symptoms which I shall now describe, placing them merely in the order of their fre-

quency, after a careful survey of many hundreds of cases personally observed.

Sleeplessness.—The physiological value of sleep is unquestionable, whether we merely look on it as the time for rest, or as an indication that no bodily or mental disturbance is there to prevent it. Inability to sleep, wakefulness during the whole or part of the night, is a sign of considerable import in estimating the amount of injury and of shock which the nervous system has sustained. It shows that something has happened to break the most regular habit of life, and to interfere with the healthy equilibrium and function of the whole nervous system. This continued sleeplessness may be a source of the greatest possible distress to the patient. He goes to bed tired and worn, and ready to fall asleep, but no sooner is his head on the pillow than he is seized, as it were, with an unnatural and dominant wakefulness which positively prevents him from closing his eyes. Or he falls asleep, and soon wakes again, and has to pass through a night of intense wretchedness, nervous and alive to the slightest sound. The furniture creaks or the mouse gnaws. Night after night this goes on, and he tells you that if he could only sleep he is sure he would be well. And what he says is very true, for not only has there been no serious shock to the nervous system of the man who can sleep comfortably and well after a railway accident, but on the other hand also, the return of sleep, after it has been long absent or disturbed, is a very certain sign that the nervous system is regaining its equilibrium and tone. It must not be forgotten, however, that sleeplessness may be due to other causes than the original nervous shock, and that it may form a prominent complaint in those cases where convalescence is being prevented or retarded by circumstances of which I shall speak at a future page. Its value is thus to some extent impaired as a diagnostic symptom of general nervous shock from railway collision, unless it be at periods not remote from the time of accident; and, furthermore, there is frequently no means of knowing whether sleeplessness is undoubtedly present, for the reality of its existence may have no other basis than the uncorroborated statement of the patient himself.

Disturbances of the Circulation.—Disorders of the circulation, whether of the heart itself or of more peripheral parts of the circulatory system, play a no less important part in the

nervous derangement than inability to sleep, and are very commonly to be met with in cases of general nervous shock. It has been pointed out already that the shock originally showed itself by some degree of cardiac paresis, by smallness, feebleness, or slowness of the heart-beat. It is a natural consequence, therefore, that in the more serious cases of nervous shock, especially where continued mental terror and emotion tend to perpetuate the nervous disturbance, derangements of the circulation should be frequent and long-continued. The patients complain of palpitation, and palpitation from altogether trifling causes. The cardiac innervation may be so disturbed as to induce great frequency of the pulse, which may vary from 100 to 150; but far more commonly the palpitation is occasional, and it is only from exciting causes that the pulse-beat is increased. It is important to remember this in the examination of patients, for if you count the pulse only at the beginning, and omit to count it at the end of examination, you may be led to believe that the cardiac disturbance is more serious than in reality it is; and by the opposite error you may fail to discover any cardiac disturbance at all. A perfectly steady pulse throughout the whole examination tells its own tale. Nay, the rate, the character, and the excitability of the pulse form an almost metrical indication of the amount of disturbance of the nervous balance, strength, and tone; and the pulse is often the only sign there is to guide us to a right estimate of the patient's condition. It is important, however, to learn as far as possible the character of the patient's circulation before the accident, and the existence of any constitutional states or diseases, of which gout is perhaps the most common, which may give rise to functional cardiac disorder.

But while the state of the pulse may form the test of what we may call the grosser circulatory disturbances, there are yet other symptoms which are by no means uncommon. The whole vaso-motor system may be deranged; and when you hear the patient complain of alternate sensations of heat and cold, or of flushing of the face and head, or when you find that at one time his hands and feet are unnaturally warm, and at another unnaturally cold, there are evidences of disturbance in those peripheral parts of the circulatory system which are not necessarily or immediately under the same nervous influence or control as the heart itself. The functional

strength of the vaso-motor system has been weakened—it has lost its nervous tone or healthy balance; and the loss is shown by the symptoms which have been named, as well as by the occasional presence of well-marked tache cérébrale. These disorders will be referred to again, for they seem to me to have some share in giving rise to the abnormal sensations of which complaint is often made, and whose obscurity tends to cast doubt upon the *bona fides* of the man who feels them, and who can only describe them as they seem to him. With returning health and nervous tone these various symptoms disappear, although, as will be presently shown, they are liable to be maintained by those influences and circumstances which tend to retard convalescence.

Headache.—Intimately connected with the foregoing symptoms is the complaint of headache, rarely amounting to actual pain, unless indeed there has been concussion of the brain. "Pain" is so relative a term, however, that it is difficult to estimate it at its true value, depending so largely as it does upon the idiosyncrasy of the individual. More common than actual pain, or the sensation to which the word pain would be applied, is a sense of weight or oppression. This feeling of heaviness may be at any part of the head, but is most common at the back of it, over the whole occipital region. Occipital oppression or pain is, indeed, the headache *par excellence* of neurasthenia. It may be always present, or be brought on by attempts at mental occupation—by reading, talking, agitation, or want of quietude. Alcohol nearly always increases it. These sensations are doubtless to some extent dependent on the irregularities of circulation which have been named. The exciting causes of palpitation, or of alternate sensations of heat and cold, may at the same time indirectly give rise to morbid feelings of weight and heaviness in the head. Hence, also, have origin the sensations of giddiness and swimming in the head when the patient suddenly rises from the recumbent posture, sensations not uncommonly experienced by those who are first beginning to move about after serious and weakening illness. These various abnormal sensations are, moreover, largely due to the sleeplessness which is so common, and which invariably shows itself in impaired mental power, as long as the brain is deprived of natural rest. Occupation of the mind very early induces brain fatigue, and

this fatigue is revealed to the patient by pain or oppression of the head and by an indefinable sense of worry. And as long as the general prostration leads to lessened bodily activity, derangements of digestion, constipation, and the like, tend in a still further degree to make headache a not uncommon complaint of those who are suffering from general nervous shock. Bring about sleep and natural rest, improve the cardiac tone by restoration of the general health and strength, and it will be found that the headaches and the brain fatigue soon pass away.

Nervousness.—Under this heading must be placed a variety of complaints and symptoms which are very indefinite in character, and which often have no more substantial basis than the statements of the patients themselves. But they are the kinds of complaints which, in my judgment, display the alliance between the state of general nervous depression and true hysteria. Not that this association is always to be found or is always obvious in cases of hysteria, but that in this particular series the one is very much dependent on the other, owning a common cause, and possibly due to the same underlying condition of the nervous system. Complaints of being easily startled, of a sense of depression and melancholy, of trembling under excitement, of a desire to be alone and to avoid all noise, of hopelessness as to future prospects and the possibility of recovery, of agitation in the presence of others, of globus hystericus—these are often heard, and their nature is sufficiently obvious; and beside them may be placed in the same category sighing and panting, screaming at night, irritability of temper, stuttering and stammering, feebleness of voice, and the other hundred-and-one complaints and symptoms which may be taken as evidence of nervous prostration and loss of tone, of the patient having been reduced to a more or less emotional or hysterical state, wherein loss of control is a prominent feature, whether it be as cause or effect, of the strange condition in which the patient seems.

Disorders of Secretion occupy no small place in the clinical picture of cases of general nervous shock. Excessive sweating is one of the most common, and is an objective sign of wrong somewhat less vague than the subjective symptoms last referred to. It is an evidence of impaired nerve function, and is a symptom, when it occurs without obvious exciting

cause, of general weakness and prostration, and of disordered and weakened function of the nerves which control the action of the sweat-glands.

Here also, in all probability, we should rightly include those vaso-motor disturbances which, limited to special regions or tracts, may also give rise to very obvious symptoms. Of these polyuria is the most pronounced, and may be the starting-point of much future trouble with the bladder, for the frequency of micturition which it necessitates may continue as a nervous affection long after the original cause for it has been removed. Menorrhagia is also not uncommon, coming on within a few hours of the accident, and wholly independent of any normal menstrual period; and in several cases profuse diarrhœa has begun almost immediately after a railway collision. These also must be regarded as kindred signs of vaso-motor disturbance, dependent, in all probability, on some exhaustion or paresis of the vaso-motor centre—if there be but one—in the upper part of the spinal cord, or of the vaso-motor centres—if there be many—in different parts of the cerebro-spinal system. How strange and inexplicable the symptoms may sometimes be, was well shown by the case of a woman who was terribly frightened by the thought that an accident was going to happen to her child, and who was herself knocked down on the platform at a railway station. She had had polyuria some years before, and it now came on again soon after this accident. It lasted for several weeks, with one exception of twenty-four hours, during which it was replaced by an enormous flow of milk from the breasts. She was not at the time suckling. Cases such as this seem to support experimental observation as to the presence of vaso-motor centres in the cerebral hemispheres, and better to explain the intimate association of emotional and vaso-motor disturbances than if the centres lay in the spinal cord alone.

Photophobia, Asthenopia, and Size of the Pupil.—In some of the worst cases of general nervous shock we may occasionally meet with a considerable degree of photophobia. This is usually a transient symptom in the days soon after the accident, and is merely an evidence of the severity of the shock and of the need for absolute quiet. The patient finds a strong light unbearable, just as he cannot bear any loud noise. Far more common is the subsequent complaint of defect of vision,

even when there has been no damage to or near the eyeball. "I can read for a short time, and then the lines all seem to run together," the patient tells you; and he thus describes a symptom, like those which have gone before, of prostrate nerve force. The asthenopia is due in nearly all cases—whether there has previously been ametropia or not—to loss of accommodative power, a result of the general weakness and depression which render any sustained effort difficult or impossible. It is merely another sign of easily-induced fatigue; and in those persons who have neither error of refraction nor presbyopia, the asthenopia will disappear—as the general muscular fatigue and the brain fatigue will disappear—with returning health and strength. The asthenopia is precisely the same as that which is a not uncommon symptom of hypermetropia, and which may be felt for the first time after an exhausting illness or during the weakness induced by prolonged lactation. In vigorous health the accommodative power is adequate to overcome refractive error and to prevent fatigue of vision; reduce the strength, and asthenopia ensues as a direct consequence of weakened power of accommodation. It is very doubtful whether this power will ever be perfectly restored to its original strength in those who have abnormal refraction, or in whom presbyopia is either imminent or advanced. Thus you find it occasionally happen that persons, who have suffered from the shock of a railway collision, must in future years wear glasses to correct the refractive error of which they had not been conscious before. It is in these cases of induced asthenopia that muscæ volitantes are so commonly seen, and so often alarm the patient. They are of no pathological significance whatever, and as a matter of fact there are singularly few persons to whom they are not at times apparent.

The size of the pupil often affords valuable evidence of the state of the nervous tone. A widely-dilated, sluggish pupil is incompatible with a healthy tone of the nervous system, as, conversely, a small pupil, which readily varies according to the degree of light, is a rare accompaniment of exhausted nervous strength. Whatever be the physiological explanation of these facts, the size and activity of the pupil should always be taken into account in endeavoring to estimate the amount of general nervous prostration.

The Optic Discs.—At this point it may be well to consider whether, in addition to these various ocular phenomena, there is a risk of any more definite pathological change arising in the deeper structures of the eye. In my former work I entered at some length into this question, and the conclusion, drawn from my own observations and the records of published cases, amounted practically to this, that there was no evidence of pathological change being common in the cases of spinal injury and general nervous shock, such as are seen after railway collisions. I had often heard the retina described as congested—whatever that expression might mean—but I felt sure that too little account had been taken of the innumerable varieties of shade and color presented by the normal fundus in perfect health, and still more, I will now add, of the appearances produced in healthy discs when refractive errors, hypermetropic astigmatism, and the like, had not been taken into proper account in ophthalmoscopic examinations. I emphasize these conclusions now, not alone because further experience supports them, but also because the matter has been more recently and very fully investigated anew by Mr. Thorburn, to whose work the reader must refer. He is in substantial agreement with what has been said here. Thus he writes: "Slight spinal injuries are very common, but there is no evidence that they tend to be followed by changes in the optic disc. Such injuries are, however, in rare cases" (he himself having met with two only in 400) "followed by chronic meningitis or myelitis, and in the latter condition there is an *a priori* probability that optic neuritis may supervene. Both of these affections are, however, very rare, and with the exception of Dr. Clifford Allbutt's eight cases, in which we have not the material for an accurate diagnosis, there is but one recorded instance of this conjunction" (op. cit., p. 178). Furthermore, speaking of the traumatic neuroses, he says: "Here changes of the optic disc are so rare that among the numerous railway injuries which have come under my own observation, and which include many severe cases of traumatic neurosis, I have seen but one doubtful case of lesion of the optic disc." In no instance has he seen the functional eye symptoms followed or accompanied by organic changes, although examination of a few recorded cases makes it "appear that there is an *a priori* probability that the functional traumatic neuro-

ses may give rise to changes in the optic discs." These changes are indicated by transient vascular disturbance.

The sufferer from spinal sprain and its frequent accompaniment, nervous prostration, has therefore small cause for anxiety on this point; while at the same time every care must be taken that any pathological changes discovered are not the result, to use Dr. Gower's words in writing of this very class of cases, "of an affection of the mind of the observer, rather than of the eye observed" ("Medical Ophthalmoscopy," 2d ed., p. 169).

Loss of Memory.—Complaint of "loss of memory" is common, and yet the phrase is hardly an appropriate one to convey an accurate description of that which the patients usually mean by it. This so-called loss of memory is not an inability to recall the events and incidents of past life, but is rather an incapacity for sustained thought, and for continued application to the work which may be taken in hand. It is a lack of the power of volitional attention, and is an indication of easily-induced fatigue. It is not a symptom of serious import, nor is it evidence of mischief in the brain. The nutrition of the brain, as of the rest of the body, is for the time impaired, and there is failure in the power of concentration and attention. It is merely another phase of the general weakness, and of the inability to apply himself to any settled occupation, which a patient very naturally feels under the sense of weakness and depression incidental to the nervous state in which he is. That this is the true explanation is frequently shown by those who make the most complaint. They can relate every incident of the accident, and of the events which followed it, and they are perfectly accurate as to the dates of many occurrences in their lives both before and since, but they are unable to apply themselves to work, or to collect their thoughts, or even to engage in conversation.

Catamenial Derangements.—Menorrhagia has been already named as a not uncommon and immediate consequence of the nervous shock. Suppression of the catamenia, either at the moment of the accident, or as a subsequent concomitant of the general nervous prostration, is likewise not infrequent. Who shall say what determines the one or the other? The catamenia may thus be suppressed for several months—in fact, until the neurasthenical condition has passed away. At

any rate the return of the periodic flow is usually coincident with a marked improvement in the general condition. As to pregnancy, this may be pointed out as a remarkable fact, that railway collisions rarely produce abortion or premature labor —strong evidence that the concussion is not as violent as it is often thought to be, for disturbance of the uterine contents is one of the recognized causes of induced labor. But although the fear of miscarriage need hardly be entertained, it is only natural that the injured woman should feel more than ordinary anxiety as to the coming labor. As a matter of fact, the neurasthenia keeps this anxiety alive, while the anxiety in its turn keeps up, or even in the circumstances develops, the neurasthenia. Suffice it that it is very unusual for any marked improvement to be noted until after the confinement. Then follows the natural result, from joy that a man is born into the world.

The Genito-urinary System.—Every one is, of course, familiar with the risks of retention of urine in all cases of profound shock, and this should never be lost sight of in the case of persons injured in railway collisions. Unrelieved hyperdistention of the bladder may be the cause of much subsequent trouble from the atony thus induced. The general muscular feebleness, which is a marked feature of the state of neurasthenia, may also in both sexes be a further reason why the bladder is not completely emptied in micturition; and if, as has already been remarked, to these causes be added an inability to get out of bed, there is almost certain to be some residual urine—the commonest and most generally acknowledged cause of cystitis.

As to sexual matters, this only need here be said, that, as long as the neurasthenia lasts, there is not likely to be either the desire or the will. Both will return in due time, but before that time neither should be gratified, for the smallest degree of sexual exhaustion is sure to be most prejudicial to recovery. Conjugal isolation should be rigidly enforced as a matter of treatment.

The Digestive System is ordinarily much deranged. The nausea, and even the vomiting, which have accompanied the early collapse, are both prone to continue, and the patient acquires an absolute loathing for food. The bowels are costive from the confinement to bed or the house, and the tongue

becomes thickly furred. All this is obviously most hurtful to the neurasthenical state, and it has a large share in producing the wasting and muscular flabiness which are soon developed. The wasting, however, is not due to this alone. The general nutrition is interfered with because of the nervous depression, whereby the proper and requisite nervous stimulus is withdrawn from the digestive and nutritive processes. Admittedly this is theory only, but there can hardly be much question that the health and vigor of the nervous system are essential for the orderly working of every other function in the body, and the action of the nervous system in connection with the functions of nutrition and digestion is not more, nor is it less, incomprehensible than is its action in connection with the circulatory or reproductive systems. At any rate, marked general wasting is often a striking phenomenon in cases of neurasthenia, and impaired nutrition may frequently be the cause of bad sleep.

Prognosis—Exceptions to the Usual Rule.—There have thus been brought together a number of the symptoms and complaints which make up the condition to which the term "neurasthenia" is nowadays commonly applied. It is synonymous with that of "general nervous shock," which has been used so often in these pages; and though there are many objections to it, it is on the whole a convenient clinical phrase. It has at any rate no underlying suggestion as to the pathology of the condition which it is meant to indicate. Of the pathology of the varied complex of symptoms which we call neurasthenia nothing indeed is known. We say there is general depression of nervous force, a dynamic, not a structural change, resulting for a time in the manifestation of one or all of the symptoms which have been named. For a time only: because, however severe the symptoms may be, the prognosis of these cases is usually favorable; and with appropriate treatment, and the avoidance of all things likely to foster the nervous depression, there will come a restoration of the nervous strength and tone, and the evidences of its former depression will pass away.

This is the ordinary rule, but the gravity of the condition is attested by occasional, by happily very rare, instances, in which the result is different. The history of nervous shock would be incomplete were no mention made of the fact that

death sometimes ensues as a consequence of uncomplicated nervous exhaustion. No case of this kind has fallen under my own observation, but the following examples were communicated to me by a surgeon of large experience in railway injuries, the only cases, it may be said, which he had met with in a period of more than thirty years.

Case XIV.—*Severe Shock—Death from General Nervous Prostration.*—A man, forty years of age, of exceedingly delicate physique, was in a collision at night. The accident was a slight one, and he was the only passenger injured. He was said, in the official report, to be "violently shaken," but he was able to go on home. The next day he was delirious, and on the third day he was still talking somewhat incoherently. He complained of being much shaken, and of feeling seriously injured, but there was no evidence discoverable of bodily hurt. He improved for a time, and his condition was not thought to be serious. He never seemed, however, to make any marked progress, and four weeks after the accident he became more prostrate, and greater anxiety was felt about him. From this time he gradually got weaker and weaker, and died on the thirty-seventh day. No organic disease whatever was found on post-mortem examination in any of the viscera. The lungs were greatly congested, and the cavities of the heart were distended with blood, as if death had occurred from failure of respiration and circulation.

The accident was regarded as the unquestionable cause of the death. Though moderate in character, it no doubt exercised a very unusual influence in depressing vital powers—never very strong naturally—and finally induced such an amount of nervous exhaustion as to terminate fatally, even though there were no evidences before or after death of physical injury to any one part.

Case XV.—*Severe Shock from Fright Ending Fatally.*—The other case was that of an apparently strong and healthy girl, nineteen years of age, in good position in life, who was in a most serious collision. She received no bodily injury, but on the night of the accident she woke screaming that the engine was rushing into the room. Her illness followed much the same course, and she died in about five weeks, no struc-

tural disease whatever being found after death. The brain and spinal cord were examined in both instances.

Cases such as these are happily most rare. They are not peculiar to railway accidents, and similar examples of death from mental shock, without any organic change discoverable, are recorded in works on nervous diseases.

The Complex of Symptoms.—Taking a final view of the symptoms and cases recorded, one can hardly fail to see how indubitably all of them point to a state of lowered nervous action or tone, and that there is a weakening and depression of every function which is under nerve control. In other words, the function of every organ and structure in the body is affected. There is mental weakness and there is physical weakness; weakness of will, of attention and power of thought; weakness, or easily-induced fatigue, of the special senses which minister, both consciously and unconsciously, to the processes of the mind; feebleness of voluntary muscles and general lack of muscular tone: and feebleness of the involuntary, as shown by the character of the circulation both central and peripheral, by want of tone in the bladder wall, and by feeble peristalsis in the intestines; depression of the secretory apparatus indicated by sweating and other vaso-motor disturbances; impaired digestion and nutrition, and loss of sexual vigor—each and all bear witness to the nervous exhaustion and depression, to the wide-spread weakness which results from the nervous shock, and is expressed in the convenient word "neurasthenia."

CHAPTER III.

GENERAL NERVOUS SHOCK—(*Continued*).

I SHALL now consider some of the causes which contribute to prolong the symptoms which have been described in the last chapter, and shall endeavor to show wherein there is an alliance between the state of neurasthenia and the development of conditions which are more distinctly of an hysterical type. For although on paper it may be an easy thing, and for purposes of clear understanding a useful thing, to separate the different effects of railway collision into distinct classes, I yet entertain no doubt that neurasthenical and hysterical, or so-called functional, disorders of the nervous system are closely linked together, and are very often to be found side by side in the clinical picture presented to us. They have a common exciting cause, and both may begin at the moment of the accident, as those cases show in which an outburst of "acute hysteria," to use Mr. Thorburn's phrase, has occurred immediately. More commonly, however, the signs of hysteria are developed at a later period, and are developed, I believe, through and by the intermediate agency of neurasthenia, which, as it were, prepares the nervous system, or puts it into a suitable state, for the origination of true hysterical disturbance. The profound psychical shock of a railway collision may there and then determine some grave hysterical disorder of the emotions only, or of some more definite function, such as that of common sensation; or it may do so only after there has been sufficient time for the nervous system to reach that condition of functional weakness in which hysterical disturbances are prone to arise. Neurasthenia is that condition; and a very common sequence of events is for hysterical disturbances to be grafted on to the neurasthenical state—grafted on to it, and thereafter growing with it. I mean no more than this when I say that they are linked together, and although I have sought to convey the impression of a close alliance between the two conditions and their respective symp-

toms, I am yet in substantial agreement with Mr. Thorburn in his opinion "that neurasthenia and hysteria are distinct, and that, often as they are found in combination, neurasthenia is common without hysteria, and hysteria is at least not unknown without neurasthenic symptoms" (op. cit., p. 189).

Sex plays but a small part in the association, and although in ordinary life women are more commonly emotional than men, it is nevertheless true, that as the direct and indirect outcome of the nervous shock of a railway collision, men may become no less emotional and hysterical than women. "The frequency of hysteria in men is not fully recognized," Mr. Furneaux Jordan wrote (op. cit., p. 27) some years ago; but we all know now that a condition closely allied to, nay identical with, the hysteria of women, is commonly developed in men after the great psychical shock of a railway collision or through the neurasthenia induced thereby. I shall waste no words in academic discussion as to the use of the term "hysteria" as applied to men. When a better is invented it shall be used, but in the mean time we have to consider the why and the wherefore of the distressing condition to which a strong and healthy man may be in time reduced—a condition in which all control of the emotions is well-nigh gone; in which he cannot sleep because he has before his mind an ever-present sense of the accident; starting at the least noise; lying in bed almost afraid to move; his heart palpitating whenever he is spoken to; and unable to hear or say a word about his present condition and his future prospects without bursting into tears.

The long continuance of such a condition forms an obvious exception to the ordinary rule—to the rule, with which all are familiar in every-day practice, that convalescence is soon entered upon, and that the symptoms of the original shock become gradually less severe, and in the course of a few weeks or months glide almost imperceptibly into a state of health, so that the man is able once more to resume his business, and to engage in the pursuits of life. Convalescence, however, may be unduly delayed after the shock of a railway collision, the symptoms and their duration seeming to be out of all proportion to the injury sustained; or, convalescence having once set in, and the patient being almost well enough to resume his work, the symptoms may recur in all their severity, and the period of recovery be much delayed. What are the reasons

which conduce to this protraction of the illness, and which conduce also in great measure to delay in convalescence, when all the circumstances, the amount of injury, and the evidences of initial shock, pointed in the direction of very early recovery?

Comparatively little has been said hitherto of the bodily injuries received, and it has been assumed throughout that the causes originally at work to bring about the shock and its after-consequences were essentially psychical. The fact, however, must never be lost sight of, that there are few cases of nervous shock after railway collision, in which some bodily injury has not likewise been sustained. The mode of accident, as we have already seen, has a tendency to cause injury of the vertebral column, an injury which in the majority of cases is a simple sprain of the spinal muscles and spinal ligaments, with severe vertebral pain as an inevitable consequence. Sprains are, moreover, not unlikely to have been received in other parts of the body, even when the patient was perfectly conscious at the time that he had no blow, and not a mark is subsequently to be seen. Hence it comes to pass that from the inherent nature of the bodily injuries themselves, pain in various parts of the body—in the trunk and in the arms and legs—is very liable to come on some time after the accident, to be severe in character, deep-seated in position, and from the absence of all bruising, seemingly most obscure. Psychical causes are again at work to aggravate the patient's condition. His mental balance has already been upset by the shock of the collision, and it is disturbed still further by the onset, the character, and the obscurity of the pains which supervene. And this result is most likely to occur in those cases where the appearance of the pains has been delayed for two or three days. They renew the alarm of the injured man, his attention is thereby more closely directed to them, and their import becomes gravely aggravated in his mind. These pains, moreover, are prone to increase in severity during the first few days, and to last for a long time, and their very duration tends to maintain the exaggerated estimate which has been formed of them by the patient himself. Nor does familiarity with them lessen his alarm, for the original psychical disturbance has laid the sure foundation for an altogether erroneous estimate of the sensations which he feels. And thus you find that before very long the mind of the patient,

unhinged by the shock, and directed to the pains and other abnormal sensations of his body, tends as it were to run riot with the symptoms which he feels. Dwelling constantly on his bodily sensations, he is on the lookout for any new sensation that may arise, and is alive to and makes discovery of sensations, which to the healthy have no existence at all. Perhaps he even keeps a chart of his back or of his whole body, and marks down from day to day the precise spots where he has had some queer sensation, ache, or pain.

Is it possible that a large number of the abnormal sensations which are thus discovered, and of which patients so frequently complain while the mental balance and tone are thus perturbed, can be due in any measure to a conscious perception of the sensations of organic life? The "hysterical" condition is essentially one in which there is loss of control and enfeeblement of the power of the will, and amid the various ways in which these may show themselves, there is loss of the habitual power to suppress and keep in due subjection the sensations, which are doubtless associated with the various functions of the organic life of the individual. In the process of evolution toward a higher state of intellectual activity and endowment, man has become more and more unconscious of the sensations, which of necessity accompany the functional activity of the various organs and structures of his body. That the stomach, for example, the liver, the heart, the ovary, the œsophagus, are, as are the organs of special sense, represented somewhere and somehow, though in less degree, in the sensorium, is highly probable on *a priori* grounds, and is, moreover, established by the experiments of morbid physiological action, in originating those abnormal sensations, which may affect these and other parts by an aura at the commencement of an epileptic discharge. And if in perfect health of body and stability of mind these varied sensations play little part in the sentient life of the individual, it is because the intellectual development of man has enabled him to control them, and to allow them neither lot nor share in the sentient consciousness of active life. In the lower animal, whose brain is hardly differentiated from the other parts of its nervous system, or which has no brain at all, the organic sensations doubtless have a more important part in the economy, and probably in the enjoyment of life; but as we step higher and

higher in the scale of development, with increasing size and complexity of brain, the organic sensations have a proportionately smaller representation in the centres of intellectual activity. Let some sudden, profound psychical disturbance arise, such as may be induced by the shock and terror of a railway collision, forthwith the intellectual control is lessened, while the organic sensations declare their being, and force themselves into the conscious life of the individual. "If the nervous system," writes Sully, "has been slowly built up, during the course of human history, into its present complex form, it follows that those nervous structures and connections which have to do with the higher intellectual processes, or which represent the larger and more general relations of our experience, have been most recently evolved. Consequently, they would be the least deeply organized, and so the least stable; that is to say, the most liable to be thrown *hors de combat.*

"This is what happens temporarily in the case of the sane, when the mind is held fast by an illusion. And, in states of insanity, we see the process of nervous dissolution beginning with these same nervous structures, and so taking the reverse order of the process of evolution. And thus, we may say that throughout the mental life of the most sane of us, these higher and more delicately-balanced structures are constantly in danger of being reduced to the state of inefficiency, which in its full manifestation is mental disease" ("Illusions," p. 122).

And thus it is, it seems to me, that when by the profound shock of a railway collision the "higher intellectual processes" are thrown *hors de combat,* these organic sensations, which, as the same writer says, "constitute for the most part in waking life an undiscriminated mass of obscure feeling, of which we are only conscious as the mental tone of the hour," and which form "'as the vital sense' an obscure background for our clear discriminative consciousness, and only come forward into this region when very exceptional in character" (ibid., pp. 148, 149), step out of their natural obscurity, and become the foci of the uncontrolled and misdirected attention of the mind. (The reader will find some interesting and philosophical remarks on the subject in Dr. Mercier's able work, "Sanity and Insanity," pp. 85–94, 1890.)

Not one of the abnormal sensations has any organic lesion

as its basis, but that there is some physical substratum seems highly probable. Continued disorders of the circulation are the most obvious after-signs of shock, and it is not at all unlikely that many of the morbid sensations which form the burden of the patient's complaints have a real, not an altogether imaginary, basis in transient flushing, or in transient anæmia, of the affected part. Some such cause as this must be at the root of many of the sensations which afflict peripheral regions of the cutaneous surface, and not improbably of those also which are felt in the central or in more vital parts.

And as the mental state may be influenced and deluded by the abnormal sensations, so in an even greater degree may these be affected by the mind. The results of attention, of anxious attention concentrated on a part, are seen in their most aggravated forms. Pain and other morbid sensations are thus made more acute and more oppressive; they become more dominant in the mind, and less under the control of the already weakened will. Small wonder that the patient, alive to every new sensation which may arise, should tend to exaggerate its import, to describe it in terms which to the healthy man seem almost absurd, and that exaggeration should be a pronounced feature of the morbid state which is called hysteria, no matter which be the sex affected.

And out of this very exaggeration itself arises another cause of prolongation of the illness. The exaggerated estimate of the symptoms themselves leads to an erroneous estimate of the present incapacity, and to an increasing belief in the impossibility of future recovery and usefulness. Hence it is only natural that differences of opinion should arise between those who are entitled to receive compensation for the injuries and for their prospective consequences, and those who have to provide it, and who take a wholly unsentimental view of the value of the patient's health and life. Months perhaps are thus wasted in disputing about the claim; or, worse than this, the man is drawn unwittingly into litigation, and is subjected to the anxieties and worries which a lawsuit involves. What surer means than this for aggravating his symptoms? Is recovery possible under such an influence; is there not, indeed, every likelihood that the symptoms will get worse and worse, or at best will undergo no change, and is it not more appro-

priate now to call them "litigation symptoms," than those of general nervous shock?

And herein also lies the explanation of the great majority of those cases where improvement has advanced to such a stage that return to work seems on all hands desirable, and yet nevertheless when work is suggested or attempted improvement stops; and even in some instances the patient seems from that very moment to fall back and to become worse than he was before. For, as a matter of fact, it is very rare to find the patients return to work while the question of compensation, and the possible disputes attending it, remain unsettled. Now and then you may meet with a patient, over whose plans and resolves the time and matter of compensation have little influence, who returns to his business with every benefit to himself at the moment when he has sufficiently recovered to do so. Such instances, however, are the exceptions to the rule, and occur probably in those only whose mental balance has never been very seriously upset, in whom the symptoms of general nervous shock have not been severe, or who have the good judgment not to allow these matters to weigh upon their minds. The experience of hosts of cases establishes this fact, that patients will not, or cannot, make the necessary effort to resume work so long as the settlement of the pecuniary claim has been uneffected. And thus, in addition to the worries and anxieties of litigation and dispute, there arises another very potent cause for continuance of the symptoms, and for inducing a state of chronic invalidism, which is far more dependent upon the circumstances of the moment than upon the original nervous shock received. This cause is the want of occupation. Can anything be worse for a man—is there anything more likely to lead to irritability and fretfulness, to sleeplessness and loss of appetite, to nervousness and anxiety about himself, to hopelessness as to the future, to a lack of power to concentrate his attention upon anything which he may have in hand—is there anything more fitted to disturb the relation between the *mens sana* and the *corpus sanum* than want of healthy occupation? And when this goes on for months and months, each month more wearisome and more wasted than the one before, is it to be wondered at that the picture which these patients present is often lamentable indeed? Still more wretched is it likely to become

if, in addition to the want of occupation, the patient has remained altogether in-doors, and has been deprived of the good which healthy bodily exercise might have done him.

Make all the allowance that may honestly be made for the special circumstances of terror attendant upon a railway collision—and I would not for a moment seek to lessen their real influence—and compare the state of one waiting for compensation, whom for the nonce we will call a railway patient, with the state, as nearly similar as may be, of a hospital patient who has had no compensation to look forward to, and who has been compelled to resume his work as soon as he was able, and then see how different is their lot, and how infinitely less wretched is the one man than the other. The hospital patient has long ago been well, while the railway patient has been waiting, for months it may be, until compensation has been paid him, verily believing that he could not return to work and to a natural and more healthful mode of life. "Settle your claim and get to work," is the best advice which can be given a man in these circumstances. Get to work and you will soon find you have the strength for it, and will forget the gloomy prognostications of those who say that you never can tell what may happen after a railway accident, and that you ought to wait and see how things turn out.

Quite apart, however, from these various causes, the condition, life, and habits of the patient before the accident have no small share in determining the severity of his symptoms and the rate of his recovery after it. It is evident that the man who has been in feeble health, or who is in a state of convalescence from some recent illness, is likely to present the symptoms of neurasthenia in an extreme degree; as also does the man who, although in perfect health, has been living a life of hard and constant work at the high pressure which every-day competition entails. He has an extensive business, with numbers of subordinates, and wide-spread interests in connection with it, which he must himself look after, and which he cannot delegate to another. He has been in good health, but this has been his life, and he has had no holiday for the past five years. He is much terrified and slightly shaken in a collision. He does not know he has been hurt, but not many days go by before he is completely prostrated, unable to eat or sleep, and feeling thoroughly ill. His business still compels

his own attention, and so perhaps weeks go by before his obviously broken health and unfitness for work necessitate complete rest. It is difficult to say how he could have acted otherwise, but all the circumstances conduce to make his illness a long one, and to delay the period of convalescence and recovery. For however good his health may have been to all appearances before the accident, his nervous system was in such a state of tension that it was likely to give way unduly from an adequate exciting cause. This is the unvarnished story of an actual case, and there are numbers like it. So, also, we may find a nervous system ill prepared to bear the brunt of a railway shock in those of intemperate habits—habits of intemperance not in matters only of food and drink, to which the word is supposed commonly to apply, but habits of intemperance also in regard to the sexual desire. This is in my judgment a far more powerful predisposing cause of the neurasthenical state than errors in diet and alcoholic excess. At any rate, such causes as these must be borne in mind if we would seek for the reason why the symptoms are severe or are being unduly prolonged. Treatment is little likely to be of use unless they are recognized and put out of the way.

It is a striking fact that in cases where there has been serious injury to limb, such as simple or compound fracture, even if at the time of the accident the collapse was extreme, it is most unusual to meet with the protracted after-symptoms, which have been described as due to general nervous shock.

Case XVI.—*Severe Bodily Injuries—Absence of Prolonged After-symptoms of Shock.*—A man, aged forty-seven, was in a very bad collision at night, and in addition to severe bruises and burns about the face and body, he had a simple fracture of one fibula, and a compound fracture of both bones of the other leg just above the ankle. There was naturally great collapse, but he rallied in the ordinary way and did well. Six months after the accident his general health was good; he was well nourished, he had no nervous symptoms, his pulse was quiet, and sleep and appetite were both excellent. Nor were there any after-symptoms, for at the end of five years he was reported as feeling no ill effects whatever from the accident, save a little pain and stiffness in the ankle when the weather was cold. Never at any time were there neurasthenical symptoms.

What is the reason that in a case such as this, and in others like it, there should be so marked an absence of the after-symptoms of general nervous shock, when originally the collapse was very severe? In psychical conditions lies, I believe, the explanation of this seeming anomaly. In the very definiteness of the injury there is something on which the mind of the patient can dwell with a certain measure of satisfaction, for, as far as he knows, the usual result after fracture is perfect restoration of health and bodily usefulness. The collapse subsides, and the patient finds himself with an injury not more obscure, it may be, than that of a broken leg. He knows that he has been doomed for a time to his bed, and that as soon as he is allowed to be up he will begin to move about again and to get well. The injury is definite and precise, its symptoms are obvious from the moment it was received, it lacks the seeming obscurity that is a feature of those symptoms which only supervene after several hours or days, there is probably less pain as time goes on, and all the circumstances combine to induce a repose of mind, which is absent from the commoner cases which have been considered. And there is also the necessity of complete bodily repose from the moment that the patient can be placed in bed. The enforced rest is good both for body and mind. Confinement to bed at an end, the patient is only too thankful that he is able to move about again, and gradually begin to walk. Returning strength goes hand in hand with returning possibility of exercise, and there is less excuse for staying in-doors because of the fear that the after-consequences of some wholly obscure injury may turn out very serious. There is, moreover, less likelihood of dispute arising as to compensation, and the money calculation becomes all the easier and the readier, because the nature and extent of the injury can be definitely appraised. Thus the absence of the symptoms of continued nervous shock in cases of bodily injury, where the amount of true collapse may have been originally severe, throws light on the symptoms which the more ordinary cases present, and tends to support the view that those symptoms are due to mental causes rather than to the bodily injury or to any vibratory jar sustained.

And how largely the continuance of the symptoms is due to mental influences is shown, perhaps even more conclusively,

by the speedy recovery which often ensues, when the exciting causes of the symptoms are removed. It is all very well to say, it is a diagnosis easy enough to make, that so-and-so, who recovered as soon as his claim was settled, was shamming, and that his symptoms were altogether untrue or wilfully exaggerated; but this will hardly suffice in explanation of the symptoms which have caused so much anxiety and trouble, and have been so little amenable to treatment. Suspense is at an end, and there is nothing any longer in the way of his making the requisite and successful effort to resume his work. "How long I have been ill, how little I improve, how small seem the chances of my recovery," have been the uppermost sentiments in his mind, and they speedily give way to this one, which is wholly different and far more hopeful, "How soon shall I be well?"

It remains to be considered to what extent recovery is possible in these cases of nervous shock, and how far the patient regains the mental and bodily vigor which he had before the accident. Happily the record of cases known to me is conclusive upon this point, that recovery is usually complete, and the patient is able to resume his occupation and to carry on his business as well as he did before. There are, of course, exceptions to the rule, exceptions which show that some alteration has taken place in the bodily physique, and very possibly in the mental vigor also. Thus you may hear that the man is less able to bear prolonged fatigue, either bodily or mental; that he is more susceptible to the influence of alcohol, more irritable and easily excited; that he lacks that complete self-control which he may formerly have had in his business relations with his fellow-men; that he is nervous when travelling, is afraid to ride or drive, and has been compelled to give up his hunting and shooting; that he is a more nervous man than he was before, and more subject to headaches; and in the severer cases, that his hair has turned gray, and he looks prematurely aged. Some years have been added to his life, and he is never quite what he was before.

And here very appropriately arises this important question, How far does the course of the protracted illness, apart from the nature of the original injury and shock, conduce to imperfect recovery hereafter? Remember that the symptoms have been largely those of emotional disturbance, that loss of

control and feebleness of will have been at the foundation of many of them, and there can be little doubt that an unconscious or wilful yielding to every sensation that may arise, the abandonment of the conscious self to the thraldom of the morbid state, the enjoyment, so to speak, of the luxury, not of woe exactly, but of gloomy forebodings and feelings and fears, pave the way for the impossibility of regaining, even in the best of circumstances, that complete mental stability and continuous self-control, which are the happy appanage of perfect bodily and mental health. A vicious habit is being impressed upon his nervous system, from which the sufferer will find it difficult to rid himself. If he thus allows the various influences conducive to the morbid state to have the mastery over him for weeks and months, because he thinks it better to "wait and see how things turn out," unable, or making no determined effort, to resume his natural occupation and mode of living until some wholly impossible compensation has been received, depend upon it he will suffer in the future. Or worse than this, if he keeps up the morbid state by wilful means, his moral and his physical nature are subjected to a long spread-out shock, from which it will be hard to rally. As he sows so also shall he reap.

CHAPTER IV.

THE FRIGHT NEUROSES—TRAUMATIC HYSTERIA.

I PROCEED, in the next place, to the consideration of a class of cases to which the name "traumatic hysteria" is now very commonly given. In my former work they were dealt with as examples of so-called functional or neuromimetic disorder, and although I shall still have to insist that that is their essential nature, the term traumatic hysteria has come into such general use in more recent years, that though I should prefer to call them the "fright neuroses," I intend to adopt it here. Objection has from time to time been made to the use of the word "hysteria" because of its etymology, and still greater have been the objections made to it when in company with the word "traumatic." Nevertheless I doubt very much whether it will ever be possible to get rid of the word hysteria, or if we should gain much by doing so; and if it be ever used to signify the nature of the symptoms presented by nervous disturbance occurring in the male, there is, I venture to think, no insuperable difficulty in so using it without thinking of the womb. Nor can any reasonable person doubt, after perusal of the works of Charcot, Oppenheim, Strümpell, Guinon, Thorburn, Dreschfeld, Weir Mitchell, and many others, that hysterical disorders are prone to follow and to be the result of injury. No better phrase for their description has, as far as I know, been suggested than "traumatic hysteria," and I suppose there is not a single neurologist of experience or repute, who nowadays will be found to deny that the gravest disturbance of nerve function, to which the term hysteria is more or less applicable, may be met with in the male sex, and be the result of injury. Examples will be given here in support of this contention, but if any one doubts the possibility of hysteria in the male, let him turn to the authors who have been named, and there he will find unquestionable instances which will surely carry conviction to his mind.

Do not let it be thought, that in speaking of symptoms as hysterical or functional, there is any desire to minimize their importance and it may be their gravity. Far too often, it is true, the symptoms of nervous disorder have been placed in the category of hysteria, and been forthwith regarded as of small concern; but it may be questioned whether the treatment of a case has ever been found much easier because of the diagnosis of hysteria, and it is tolerably certain that we are not much nearer the correct understanding of its nature because it has been so described. That has never been my own feeling with reference to the so-called functional disturbances of the nervous system, which are common after railway accidents. It has always been my opinion that some material and morbid change must underlie the nerve disorder, but it seems to me most unlikely that such change can be of the same nature as the coarse pathological lesions, which we are wont to see in the post-mortem room, or which are shown us by the microscope. For all we know the change may be a chemical one, and the nervous disturbance be altogether secondary. The course of the symptoms themselves, and their rapid and often very sudden disappearance, form well-nigh conclusive evidence that they cannot be due to gross pathological lesion. Nevertheless, if, at the present day, we are unable to say what is the precise morbid change underlying the so-called functional disorders of the nervous system, and must acknowledge with Guinon that, as far as known pathological lesion is concerned, they are disorders *sine materia*, we are not debarred from their clinical study; nor is the hope denied us that a close observation of the symptoms displayed may lead in time to a knowledge of their pathology, whether the change be in the affected parts of the nervous system themselves, or in their nutrition and blood-supply.

From the clinical point of view, then, we may take it as an accepted fact, that fright is a common and powerful determining cause of the onset of hysterical phenomena, and it is that element in them which makes railway collisions so fertile in functional neuromimetic disorders. Apart, however, from the immediate effects of fright, which is not always or in all cases followed by injurious consequences, there are certain predisposing conditions in the individual which have to be considered. The constitution of the nervous system may be

itself at fault, either because of inherited instability, or as the result of causes which have had injurious influence upon it. Inherited weakness may show itself in what is called a nervous temperament, such as may be obvious even to superficial observation, or as may be brought to light only by illness or disease. We all know how very variable are the effects of illness upon the nervous system, and how often it happens that those who are free from any trace of nervousness during health reveal their nervous temperament when ill. And even if the hereditary instability has never been manifested in themselves, the family history may afford strong grounds for suspecting it. (In his classical work on hysteria ["De l'Hystérie," p. 396] Briquet records that in only ten out of 396 women subject to hysterical disorders could he discover no evidence of predisposition. Thorburn, Oppenheim, and others, however, have had a somewhat different experience, and do not regard hereditary predisposition as so common.)

Moreover, in addition to the hereditary predisposition, there are predisposing causes incidental to the individual himself. Recent illness and the consequent weakness, sexual excesses, overwork of body or brain, alcoholic intemperance, the gouty diathesis with its chronic mal-assimilation and impaired nutrition, the existence of some definite nervous disease—all these things and many others predispose a person to suffer from the great mental shock which appertains to a railway collision, and to almost every serious accident whether by land or sea. For more detailed information on the manifold predisposing causes of functional nervous disorders, the reader may turn with advantage and profit to Georges Guinon's recent work, "Les Agents provocateurs de l'Hystérie." He will there learn that many of these disorders arise, not so much as the result of an immediate cause, but from the state of the nervous system being such, that an exciting cause is able to provoke it to the manifestation of functional disorder. It is in this way that railway accidents very often lead in time to functional hysterical disturbance, in that by them there is induced that condition, which has been dealt with in previous chapters, and to which the term neurasthenia has been applied.

It seems, therefore, an almost natural step to pass from the consideration of general nervous shock to the consideration of the cases of nervous mimicry and traumatic hysteria,

because the shock has been, in many instances, the means of inducing that very condition of the nervous system, which predisposes to the manifestation, and underlies the origin, of these functional nervous disorders. The cases which will be quoted, moreover, show that in the worst instances there is frequently some evidence of mental disorder in the previous history of the patient himself, or that he comes of a stock in which mental or emotional disturbances and peculiarities, not necessarily amounting to insanity, have been recognized as prominent in the family record. It has been impossible in every case to obtain evidence of the kind, but, in the absence of discoverable predisposing tendency, there is a sufficient cause for the origin of the hysterical disorder in the profound nerve exhaustion, prostration, disturbance, or whatever we may like to call it, which the moral and physical shock of the accident and its varied consequences have had upon the nervous system. We need not seek further than this for a cause of the functional disorders — the paralyses, the spasms, and the convulsions — which are mimicries of grave disease.

We may now consider in greater detail the different varieties of hysteria which are the result of injury. In the first place, and of infinitely less moment than those which have to be spoken of presently, are the convulsive sobbings, cryings, and laughter of acute hysteria, such as may come on immediately after or within a few hours of the accident. Every one is familiar with these sorts of attacks, and I say they are of comparatively small moment, because they are usually transient. They very probably give relief to nervous tension, and are thus productive of good; and experience tells that they are not followed by, or commonly associated with, those hysterical manifestations, which, copying the symptoms of real disease, are more determinedly fixed in, and are with greater difficulty eradicated from, the disordered nervous centre. They lack that fixity which is one of the most serious and troublesome among the characteristics of hysterical disorder of the chronic, as distinguished from the acute, variety. The prognosis is distinctly more favorable, and I shall say nothing more about them than this, that they are to be met with in both sexes in almost equal degree, and that it is of importance to insure perfect quietude and to avoid all reference to the

exciting cause of the hysterical seizure. Condoling friends had better keep out of the way.

Passing, therefore, to the more chronic, rarer, and more imitative forms of traumatic hysterical disorder, the multiplicity and variety of the symptoms, and the very nature of hysteria itself, render it impossible to draw up any comprehensive classification. Suffice it that the symptoms very commonly consist of disorders of motion and sensation; paralyses or contractions of a limb; diminution or other impairment of common and special sensation; convulsive epileptiform seizures; vaso-motor derangements; and more markedly psychical troubles. The varied symptoms are, I think, best studied in the record of individual cases, but I propose in the first place to say something as to the possible origin and nature of some, at any rate, of the symptoms which may be seen. In my former work I expressed my "belief that the primary seat of functional disturbance lies in the brain itself, and that, as in the hypnotic state induced by a profound mental impression, there is a temporary arrest in the function of that part of the sensorium which presides over and controls the movements and sensations of the periphery." There can, I think, be no question that the underlying cause of the neurotic symptoms, even of such as "functional paraplegia," is to be found in the cerebral cortex. The disorder has had its beginning in profound mental disturbance or shock, and the presentation of the symptoms seems to direct one entirely away from the periphery of the nervous system in search for an explanation. In paraplegia from organic disease, other than that of absolute destruction of the cord, the loss of motor power and of common sensation is rarely absolute, and the patient, at any rate, is only too anxious to show how much power of movement he has. In functional paraplegia, on the contrary, the paralysis is usually absolute, nor can any movement be elicited at all. The thing at fault is obviously the power of initiating movement. The mandate from the brain is in the one case checked by lesion in the cord, beyond which it makes its way with difficulty. It makes it, however, and some movement is the result. In the other case the mandate never leaves the cerebral cortex at all—no impression reaches the limbs, and there is no movement. When we come to consider individual cases, we shall see the same sort of defective power of the

cerebral cortex in initiating movement in such a simple act as that of putting out the tongue. Asked to put out his tongue, the patient is wholly unable to do so. Vigorous effort is made —the facial muscles and the muscles of the trunk and limbs are called into play as if they could determine the result; and the result is entirely abortive, or the tongue perhaps reaches no further than the teeth or lips. But if such a patient be carefully observed, it will be noticed that there is no impairment whatever in the movements of the organ itself: speech is unaffected, and if by any chance the automatic and involuntary act has to be performed of removing a particle of food from the outside of the lip, out goes the tongue in a perfectly natural way. This was a striking phenomenon in one of the cases to be presently recorded, in which there were symptoms of functional neurosis, such as we may conceive could not possibly be feigned; and it is the presence and coexistence of such other symptoms which enable us to establish it as tolerably certain that these defects in motor power are not fraudulent, but are likewise due to a real inability on the part of the patient to call his cerebral centres into the activity requisite for the particular movements desired. It may be difficult or impossible, mere conjecture, to say wherein the cerebral defect lies, but there seems to be neither more nor less difficulty in the case of sensory, than there is in the case of motor disorders. Both are alike inexplicable; but if defect of the will power of the higher cerebral centres be indicated by inability to perform desired movements, is it altogether inconceivable that the same cause is at work in the abolition of common sensation and in impairment of the special senses? Automatic movements continue unimpaired, purposive desired movements are those alone which fail; and it has often occurred to me when in the presence of a case of functional anæsthesia, that the loss of sensation may be quite as much a phenomenon of the moment, as is inability to put out the tongue a phenomenon of the moment when that particular and specific act has been desired. May not sometimes the very examination of a hemianæsthetic patient largely determine the hemianæsthesia, which forthwith disappears as soon as the examination is at an end? Common sensation, for all we yet know, may be quite as much both voluntary and automatic as is the power of ordinary movement; and although

we talk about a patient not choosing to do this or that, the psychical condition which determines his inability to put out his tongue may equally determine his inability to feel, and the loss of the one power may be as much, or as little, dependent on the brain activity which we call Will, as is the loss of the other. At any rate, both defects have a common exciting cause, and that is the state resembling hypnosis which is induced by fright.

We know how great is the part played by "suggestion" when the patient is in the hypnotic condition, and how it may lead to the manifestation of various motor and sensory disturbances. The examination of a patient may, therefore, it seems to me, sometimes provide the suggestion whereby anæsthesia results. Looked at in this light, suggestion and expectancy are very much the same thing; and underlying each, whether the same or different, is an abnormal, and, for the time, unhealthy condition of the higher cerebral centres, whereby a change is brought about in the ordinary relations of mind and body. Let it be granted to the full that the severe psychical disturbance of an accident, in which there has been reason for fright, is responsible for all the evil consequences which ensue, yet I have little doubt that the resultant symptoms are not altogether independent of the method of procedure which is adopted for discovery of the symptoms present or expected. To take a specific instance. If it became the custom to test forthwith the sensation of every person who has been injured in a railway collision, we should presently find the opportunities of studying hemianæsthesia enormously increased: much as in the same sort of way, when it was the custom to examine everbody's spine, injured or no, complained of or no, spinal tenderness and surface hyperæsthesia of the back were very much more common than they are at the present time. This is no merely idle speculation. Those who have had the opportunity of seeing large numbers of cases of railway injury cannot help observing how much there is of fashion in the symptoms which are seen, and a word of warning is not, in my judgment, out of place to-day.

Students of the works of Charcot know how close in his judgment is the alliance between many of the phenomena of hysteria and those which may be purposely induced in the hypnotic state. Recognizing the ease with which many con-

ditions, such as palsy or contracture of a limb, for example, may be developed by oral suggestion during the hypnotic sleep, he sees a close analogy between the origin of those phenomena and the origin of many of the phenomena of traumatic hysteria. In place, however, of oral suggestion, it is the injury which suggests the special form of neurotic disorder, and traumatic suggestion takes the place of oral suggestion in hypnosis. But as oral suggestion is followed by the desired result only when the higher regions of the cerebral cortex are in the hypnotic state, so traumatic suggestion has no influence unless the centres are in a condition allied to that in which they can be put in hypnosis. The circumstances in which the injury was sustained provide the requisite condition. Speaking of railway collisions, he says that nervous troubles often occur in such cases apart from any traumatic lesion, and simply as a result of the psycho-nervous commotion produced by, yet frequently not appearing immediately after, the accident. It is the state induced by the psycho-nervous commotion which renders traumatic suggestion possible. Turn to one of his most typical cases of hystero-epilepsy ("Diseases of the Nervous System," Vol. III., 1889, New Sydenham Soc., tr. by Dr. Savill, p. 226 et seq.), where all the prolonged symptoms had had their beginning from a severe cut on the arm, on the receipt of which the patient had fallen to the ground with hemorrhage and fright. Was the wound, he asks, sufficient to provoke the development of the nervous symptoms? No, he answers; and he would have us bear in mind that "along with the injury there is a factor which most probably plays a much more important part in the genesis of these symptoms than the wound itself. I allude to the fright experienced by the patient at the moment of the accident, which was betrayed shortly afterward by a loss of consciousness, followed by a sort of transitory paralysis of the lower extremities." The same nervous condition, which formed the psychical substratum of the hystero-epileptic phenomena in that instance, exists in all probability in those cases where some trifling injury, in the neighborhood of a joint, for example, has led to palsy, contracture, or anæsthesia of a whole limb, or to the physical signs and symptoms which imitate disease of a joint. The injury was the cause of some abnormal sensation which in a healthy nervous condition would have been totally

disregarded, but which to a nervous system, the victim of psycho-nervous commotion, fright, or mental shock, becomes suggestive of serious wrong. This, in other words, is "traumatic suggestion," and having expressed similar views in 1883, I am now in full accord with Charcot when he says that in railway collisions a "peculiar mental condition is often developed, which is intimately connected, in my judgment, with the hypnotic state. In both of these conditions, in fact, the mental spontaneity, the will, or the judgment, is more or less suppressed or obscured, and suggestions become easy. And thus the slightest traumatic action, for instance, directed to a member may become the occasion of a paralysis, of a contracture, or an arthralgia. It is in this way that one so often sees after railway accidents cases of monoplegia, paraplegia, or hemiplegia simulating organic lesions, although they are no other than dynamic or psychical paralyses, very analogous, to say the least, to hysterical paralyses." This condition, so closely allied to the hypnotic state, may be developed by the nervous shock, but I believe that it may be the result also of the neurasthenia which the nervous shock has initiated.

It is in such cases that the term auto-suggestion is, I think, more appropriate than traumatic suggestion to indicate the origin of the nervous phenomena. Nevertheless, there is no material difference between them. The thing essential for suggestion to have any influence is the special psychic state, induced immediately by nervous shock or through the intermediate agency of the general nervous depression, which, for the sake of brevity, we call "neurasthenia." And in many other ways than in affections of the limbs and joints, auto-suggestion has, in my opinion, much to do with the origination of symptoms which are clearly of the nature of hysteria. That some form of local paralysis should be a very frequent result of suggestion is not a matter of surprise, when we remember how very commonly local injuries, and local injuries of no great severity, as has been previously pointed out, are met with by the sufferers in railway collisions. The sense of heaviness and numbness which follows a blow, more especially if in the excitement of the moment the person has been unconscious of having been struck on any one part, is very likely indeed to suggest the notion of paralysis. It is astonishing how often after a railway accident one hears the fear of pa-

ralysis expressed, and has to recognize how very real this fear may be to the patient, and how difficult it is to eradicate it from his mind. There is much truth in Mr. Thorburn's remark (op. cit., p. 219) that "in the case of railway accidents, at any rate, the general public of this country has been educated to expect 'concussion of the spine' with paralysis, and that, in the minds of the laity, the very mention of a railway accident calls up the required idea." If the reader will recall what has been said as to traumatic lumbago, and the symptoms which frequently accompany it, he will have no difficulty in appreciating Mr. Thorburn's remark; nor will he find cause for surprise that hysterical affections of the spine should be common after railway collisions, having as their basis the fascial and muscular injuries which have been described.

Touching on the subject of hypnotism, the same writer sees an alliance to it in the unconsciousness of which patients often speak, as having affected them at the time of the collision. It is a familiar fact that a period of transient unconsciousness, or a period, at any rate, in which there is no conscious impression of events, is by no means uncommon, even when those who tell of it have had no blow upon the head, and there has certainly not been concussion of the brain. I have myself regarded this as a dazed condition, the result of fright, and have never thought it strange that some persons should have been wholly unable to give any account of what transpired, or what they themselves did after a collision, when one bears in mind how terrible may be the accompanying events of a severe collision, and how vast and appalling is the contrast between everything before it and everything after. Mr. Thorburn, however, goes further than this, and is inclined to regard this state of daze as of the same nature as the state of hypnotism, and thereby he finds an explanation of the many strange and unremembered acts of persons thus affected, and of the imaginative and altogether incredible stories which they may tell of what befell them, but which they themselves, nevertheless, implicitly believe. He records examples of this nature, to one of which I may refer here, because it is the history of a man known both to Mr. Thorburn and myself, and because there was no question of compensation to throw doubts on his veracity.

"A gentleman while travelling with me," writes Mr. Thor-

burn, "allowed the train in which he should have proceeded to leave a side station without him. Seeing the train already started, he ran after it, attempted to get on, and fell on the line, sustaining fortunately no serious injury. He afterward described minutely how he had tried to get on to the third carriage from the rear of the train, but failing, had fallen behind it, and how the remaining coaches had then passed over him. To this account he always adhered, although several railway servants who saw the occurrence noticed that he jumped at and missed the last carriage, and fell behind the whole train, nothing passing over him."

Clearly in this instance there was the psychic state in which auto-suggestion might have played a part in the development of some symptom of traumatic hysteria had there been any local injury to determine it. This is what happened in the case of one of Charcot's patients, the history of which is recorded in the appendix to his lectures. Omitting many of the symptoms, it may be said that this was a case of paraplegia following an injury, severe contusions to the thighs and lower abdomen, which the man described as having been caused by a heavy van passing completely over him. The occurrence, as he believed it to have taken place, came before him often in his dreams; but it was known, as a fact, that he had not been injured in this way at all, but that he had been violently knocked down on the footpath while he was drawing his barrow. He lost consciousness immediately, remained comatose for several hours, and afterward for two or three days was in a state of intellectual torpor, in the condition suitable for the efficacy of suggestion. And the suggestion here was made by the abnormal sensations in the limbs which were the consequence of the local injury. The mental condition which this man presented is precisely that which, in varying degrees of duration and severity, may be induced by the profound psychical commotion of a railway collision. In it the affected person may do things of which he has no subsequent recollection, he may be led to believe that things happened to himself which are altogether contrary to fact, and any local injury may thereby be made the starting-point, through suggestion, of some definite hysterical disorder.

The all-powerful influence of psychical commotion and emotion is the very root and foundation also of the teaching

of Oppenheim, in his short but most valuable work on the traumatic neuroses ("Die traumatischen Neurosen," Berlin, 1889). The physical injury, he tells us, is only in part answerable for the consequences which follow. "Die Hauptrolle spielt das psychische: der Schreck, die Gemüthserschütterung." His cases were mostly those of hospital patients, and although they were regarded from a somewhat different point of view, in that he looks on the symptoms of each case as indicative of a more definite psycho-neurosis, yet this author is in practical accord with what has been written in the last chapter. It was there insisted that the psychical disturbance was the reason why the pain of some trifling injury became so magnified as to suggest all sorts of grave and enduring disorders. The injury has, of course, as Oppenheim says, a direct result; but as a rule this is of small and transient moment, unless the mental disturbance should alter its usual character and impress on the bodily disorder the features of a lasting disease. The influence of fright at the time of the accident is so great as to induce a long-continuing psychical disturbance, and this it is which determines and governs the phenomena of the traumatic neurosis. A very careful study of his writings leads me to the conclusion that there is no very great difference between the views of Oppenheim, and those which have been advanced by myself. He lays greater stress, perhaps, on the psychical element in the neuroses and less on that of nerve prostration, but both, it must be remembered, are neuroses of traumatic origin.

"Die Hauptrolle spielt das psychische: der Schreck, die Gemüthserschütterung."—The whole sensorium, apparently, may be thus affected, and may pass into a state of slumber, as is shown by mental hebetude, by lessened volitional power, by anæsthesia and analgesia, and, on the other hand, also by excessive activity of the lower automatic centres from lost or torpid cerebral control. The abnormal condition is allied in all probability to that of the hypnotic sleep, and it is, moreover, akin to it in the readiness with which the symptoms may pass away when the requisite stimulus has aroused the brain from its torpid state. The stimulus may be some profound mental or bodily impression; it may be exerted only by the more tedious influence of re-education of the movements of the affected part; but in either case the activity of the sensorium

is once more alert, and the cerebral control can be exercised in its normal and healthy way. Not less mysterious than slumber of the sensorium, whether it be of the whole or of a part, is the fact that daily familiarity with the morbid process seems to give the individual patient the voluntary and more facile power of putting the affected region of the sensorium into the state of torpor, or of voluntarily abandoning himself to the easily-induced influence of the abnormal condition. Repetition and perpetuation of the morbid condition of the sensorium make the symptoms easier of production than they were before. The man who has once been hypnotized can be more readily hypnotized again, and thus it is that in course of time the "medium" of the mesmerist or of the so-called spiritualist can be reduced by the most trumpery and frivolous influences to the hypnotic or cataleptic state, and so becomes the most pitiable of mortal men.

It has been said already, in speaking of the symptoms of general nervous shock, that the man who voluntarily abandons himself to the morbid state submits both his moral and physical nature to a long spread-out shock from which he will find it hard to rally, and the same remark may be here reiterated with even greater force in connection with the functional disorders which are results of the unnatural nervous state. For there can be no doubt whatever that many neuromimetic conditions are more or less under the voluntary control of the patient; and that, as may be seen in cases of convulsion, the mimetic seizures—in themselves typical in character—may be brought on by the will of the patient himself. And this can be done with greater ease as time goes on. Herein lies the explanation of those happily-timed convulsions which occur when it is most important that you should see them, and should be impressed by their severe reality. The seizure itself—*qua* seizure—is typical of its kind, and its phenomena lie outside the conscious control of the individual. But within his control has been the commencement of the seizure at the precise moment when it began. Thus, in speaking of the ease with which the hypnotic state may be induced in those who have been often hypnotized, Heidenhain writes: "Many of the gentlemen upon whom the above experiments have been made, need only to sit down, close their eyes, and think intently—other thoughts being excluded—that the hypnosis is coming

on, in order to, as it were, voluntarily submit themselves to the charm" ("Animal Magnetism," p. 86). And, as of the hypnotic state, so of other neuromimeses also, the patients may voluntarily submit themselves to their exhibition, and the manifestations thereof become in themselves not less real. The existence of a certain amount of control is shown, moreover, by the disappearance of the mimicries, when all cause for their representation is removed. The matter of compensation, as we have seen, exerts in many cases a very favorable influence on the symptoms of general nervous shock. It does so in these cases also, and examples are not few in which typical neuromimetic phenomena came to an end, shortly after settlement of claim had secured for the patients complete repose of mind, and had freed them from the necessity of any longer allowing themselves to be their victims and exponents.

In speaking of the objections made to hypnotic experiments, Heidenhain seeks to show that the repetition of them does not appear to be fraught with danger or evil, but he mentions cases where attacks of convulsions constantly accompanied every hypnotic experiment, and one patient who suffered after every experiment from a certain degree of nervous irritability which lasted twenty-four hours (op. cit., p. 102 et seq.). I have myself no doubt that the risk of permanent damage to the stability of the nervous system and tone must be very considerable in all persons who repeatedly submit themselves, whether voluntarily or involuntarily, to the hypnotic state, even though it is not accompanied by convulsions or is not followed by "nervous irritability." The hypnotic state is not a natural, it is a morbid state; to repeat it is to perpetuate it, and make it an abiding part of the organization of the individual. Not less does risk of permanent damage to the stability of the nervous system lie in long continuance of any functional mimetic disorders. The longer they exist the more prone are they to give rise to lasting nervous disturbance, and to the phenomena which may be the result; and even in cases where the neuromimeses pass away under returning cerebral control, the risk is by no means small that from some exciting cause the conditions may be very readily reproduced. The lesson to be learned from this is obvious, that the sooner any cause for the representation of the phenomena is removed the better, and that the patients should

as far as possible be freed from the hurtful sympathy of friends. There is little chance of improvement or cure as long as the patient need not make the necessary effort to get well, and as long as his friends, in ignorance of the real nature of his malady, foster by misdirected sympathy and kindness those very symptoms whose continuance is fraught with danger to the stability of his nervous system. The question of diagnosis is thus all-important, and once established it is doing him a grievous wrong if his sufferings and symptoms are to be made the occasion of litigation and prolonged dispute.

CHAPTER V.

THE FRIGHT NEUROSES—(*Continued*).

I SHALL now illustrate the foregoing remarks by the brief record of several cases, the symptoms of which will suggest various comments as we go on. I adopt this plan because the multiplicity and variety of the so-called functional disorders prevent any suitable classification of them, and because this is not a text-book of nervous diseases. Information is at hand, and must be sought elsewhere, as to the condition of the reflexes, for example, in the different diseases of the nervous system, organic and hysterical, and only passing reference will be made to these and other indications of nervous disorder.

CASE XVI*a*.—*Case of Functional Paraplegia—Rapid Recovery after Settlement of Claim.*—V. S., a widow, aged thirty-eight, the strong and healthy mother of seven children, was in a collision. There was no history of her having been much hurt at the time, but within a few hours she began to have a pain, or a sensation which she described as "opening and shutting," in the small of her back. The next morning she continued her journey of nearly 200 miles, and finding that in a few days the pain in her back was a good deal worse, she went to a hospital. She was an in-patient in the hospital for six weeks, during the first three of which she was in bed, suffering from pain and stiffness in the small of the back and from general weakness. For three weeks she was up and moving about the wards, and she then made a journey of 330 miles in order to take one of her children to school. This business over, she then travelled home to the place where the accident had originally happened. This was exactly two months after the accident, and as soon as she got home she at once took to her bed, suffering from great pain in the back, from much hyperæsthesia in the dorsal and lumbar regions,

and from general prostration. She remained almost entirely in bed until about fifteen weeks after the collision, when it was accidentally ("accidentally," because this is just what so frequently happens in hysterical affections. "It is necessary to bear in mind," Charcot says, "that hemianæsthesia is a symptom which requires to be sought for, as M. Lasègue very judiciously remarks. There are, in fact, many patients who are quite surprised when its existence is revealed to them."—Charcot, "Diseases of the Nervous System," New Syd. Soc., 1877, p. 250) discovered that she had lost all motion and sensation in the legs. She had complete control over both bowel and bladder, and there was neither wasting of the legs nor bed-sores. The paralysis of motion and sensation seemed absolute. The woman was at the same time exceedingly "hysterical," and complained fearfully of pain in the back and of innumerable queer sensations in different parts of the body. The opinion was given that this paraplegia was not dependent upon organic disease; that it was not feigned; and that, although there was every prospect of her recovery, it was quite impossible to say how long she might suffer from the paralysis, or how soon she might be well. She was attended throughout this illness by a trustworthy nurse, and there was never any suspicion that the woman was wilfully maintaining her condition. No material change took place in her condition up to six months after the accident, when her claim was settled. Within a fortnight she left the house where she had been staying, and in three months she was walking about without assistance in perfect health. Further account of her cannot be obtained. It is open, of course, to any one to remark that this was a case of malingering. I do not take this view, and I think it of greater interest to consider what were the circumstancse conducive to the paraplegia, and what were those which brought about her recovery. There can be no doubt that the woman received a sprain of her vertebral column, and that she had some "shock;" but of greater moment in the history of the case is the fact that the long and fatiguing journeys, which she took within a short time of the accident, must have been largely instrumental not only in preventing complete recovery from the early prostration, but even in increasing the general weakness from which she suffered. After the first journey she was compelled to go to a

hospital, and after the second and longer journey she was so much exhausted that she had at once to take to her bed.

In two other cases of paraplegia, occurring in young girls, there was very much the same sort of history. One of them was remarkable in this, that after the collision the girl lay in a dazed, semi-unconscious state for a couple of hours, having received no injury beyond a slight bruise on the middle of her back by the fall of a box from the carriage rack. Movement was painful, and she took to her bed, gradually losing thereafter the use of her legs. They became extremely cold, but there was no other alteration in nutrition, and the reflexes were quite normal. No improvement took place in this case until the patient had been taken from home, placed in a hospital, and there put under suitable treatment. It is probable that the feebleness of circulation and coldness of the extremities often noted in these cases, together with the pain induced in moving the legs, provide the "suggestion" to the sensorium which results in loss of motion and sensation. And let it be noted that the effect of the accident was to produce that condition of daze to which reference has been already made, and to which, in the etiology of such affections, considerable importance must be attached. The legs of the other girl were equally cold, and in addition to the paraplegia, she presented this characteristic symptom, flexion of and inability to extend the fingers when asked to do so, although in all automatic movements there was no impairment or defect.

The way in which cases of this kind frequently recover shows pretty conclusively that the morbid seat is in the brain. A sudden impression which compels the automatic use of the legs may in a moment arouse the torpid sensorium, or a process of re-education, beginning at the very beginning, as it were, may be needful to restore the lost movements of the limbs by reawakening the brain to a full sense of its responsibilities in the circle of the will. Cases like these may look like fraud, but I feel sure that Paget is right when he says that in many of them the "fault is rather in weakness of the will than in its perverse strength." The patient says, "as all such patients do, 'I cannot;' it looks like 'I will not,' but it is 'I cannot will'" ("Clinical Lectures and Essays," pp. 188, 189).

The cases of functional paraplegia which have been recorded

were very typical of their kind, but we shall do well to draw remaining examples from patients of the sterner and, usually, less hysterical sex.

Case XVII.—*Case of Functional Motor Paraplegia—Extreme Emotional Disturbance—Ultimate Recovery.*—T. B., aged forty-one, a man of gouty family, naturally very excitable, and able, as he said, to hear a pin drop in the next room, was in a very severe collision in which the carriage he was in was smashed to pieces. He crawled out of the débris as best he could and went on his journey, but in about half an hour he began to have retching, pains in the abdomen, and shivering. He therefore returned home. There were slight bruises about the limbs, and one on the forehead; and the next day, when in bed, he complained of pain in the right side of the abdomen and the lower part of the back, but at neither of these places was there mark or tenderness. For the next few days he seemed very ill, had severe pain in the head, occasional retching, and at night he wandered. For three days his temperature was raised. He was in a highly nervous state, and spoke frequently of a dread of lock-jaw and paralysis. Three weeks after the accident he still complained of severe pain about the sacral region, but there was no tenderness. He complained also of "numbness" in his legs, a word used by him to express not impaired sensation, but a difficulty which he felt in moving them. There was no hyper- or anæsthesia, but his walking, in which he helped himself by holding on to the furniture, was done with apparent fear and effort. He could stand quite well with his eyes shut, and there was no spasm of the muscles of the legs. His temperature and pulse were normal, and the bodily functions were naturally performed. His general condition improved, he was able to eat and sleep better, and even to get out-of-doors in a chair. He still suffered, however, from extraordinary emotional disturbance, was very irascible, and frequently cried. He continued to dwell on the fear of paralysis, and steadily lost the power of moving his legs. He made for himself an ingenious contrivance whereby he was able to move about by the support of his arms, but his legs were hardly used at all in progression. Eight months after the accident he was quite unable to walk, and failed entirely to make any requested

movements of the legs or feet during examination. The attempt to move his legs produced great mental agitation. There was no paralysis of bowel or bladder, and sensation of the legs was but very slightly, if at all, impaired. There was no material wasting. The cremasteric reflex (this case was seen before the value of patellar and other reflexes was known, and the cremastèric alone was tested) was normal. There was no rigidity or spasm, and no sign of bed-sore.

Nine months after the accident he had an attack of aphonia, brought on suddenly by hearing of the death of a friend. The aphonia lasted for three weeks, and then disappeared as suddenly as it began, when startled by one of his children rushing into the room. He also suffered from frequent nausea and retching, the least excitement, such as the visit of a friend, almost certainly making him sick. It is indeed very difficult to express in words how extreme was the emotional disturbance in this patient. He had always been a man of highly nervous temperament, likely, so it was said, to suffer severely from the shock of a railway accident.

I satisfied myself that the paralysis was not dependent on organic lesion, and eleven months after the accident reported to the railway company that the "cause of the paralysis seems to lie rather in the directing power of the will than in lesion discoverable of the brain or spinal cord." I had, moreover, no doubt that the case was perfectly genuine, but felt that it was impossible to say how long he might be ill, and that litigation would be exceedingly detrimental to him. The man himself was advised to make every effort to use his legs, and to re-educate the movements of them by daily practice. Litigation was avoided, and the claim, naturally and rightly a large one, was amicably settled thirteen months after the accident. By the kindness of his medical attendant I had frequent reports of this man after his claim was settled. For long he did nothing, and remained in a nervous hysterical state, and it was not until four years after the accident, when he made a complete change in his living and occupation, that he began to get well. Seven years after the accident, in the course of the year 1882, this was his own story, and it speaks better of his condition, past and present, than any other words. He considers that he was ill for between four and five years. He used the appliances for walking for about two years, and then began

to use sticks. Two years and a half ago he took a public-house in the country, and began to lead an out-door, active life. When he first began this, he could not get up from his chair alone, having either to be helped up, or to pull himself up by getting hold of something in front of him. Suddenly one day he got up without knowing it, and his son said to him, "Why, father, look what you've done!" "Good God!" he replied, "I have got up myself." From that day forth he was able to get up without difficulty. He still has great fear about his spine, and only a few weeks ago, when a friend struck him in the back in joke, he was terribly alarmed, and for two days could hardly walk. He can walk nine miles without fatigue and ride all day, he has gained weight, and is altogether stronger and better than he was before, regarding his recovery as due to change of life and scene. In appearance he was at this time the picture of health, and as far as his legs were concerned there was not a sign or symptom of anything whatever amiss with them, reflexes and nutrition being perfectly normal. I saw him again in 1890 in perfect health. (See a remarkable case recorded by Dr. Webber, "Boston Medical and Surgical Journal," Vol. X., p. 44, 1882—"Recovery after four years' paralysis following railroad injury.")

Case XVIII.—*Supposed Spinal Injury—Spasmodic Twitchings of One Arm, etc.*—S. B., aged thirty-three, was in a railway collision at night, when a large number of persons were more or less shaken and hurt. He himself was not injured, as far as he knew, at any one place, and no marks of external injury were at any time discoverable. He complained, however, of being shaken, and looked pale and ill. He took to his bed, and in a few days complained very much of his back, and was in a continued state of alarm about his "spine." Beyond appearing shaken and nervous about himself, he had no sign of structural injury to any one part of the body. He remained in this negative condition for some weeks, and then began to move about the house, and once or twice he went out of doors. About this time there came on a peculiar twitching in the left arm, which is thus recorded in the notes: "To-day on my arrival he was lying dressed on his bed. I asked him to go into the next room, and he got up without apparent difficulty and did so. He sat down in an easy-chair,

when his left arm and hand at once began to jerk with sharp clonic spasms or twitchings, not unlike the movements of chorea. The movement kept on when his arm was held, and he said he could not control or arrest it. It was noticeable, however, that it ceased entirely when he began to undress, partially ceased when he engaged in conversation, and altogether stopped when his attention was specially directed to some other part of his body. Coincident with this movement of the arm was a continuous jerking of the head. There was no wasting nor any sign of loss of power in the limbs." He complained greatly of his back, and evinced tenderness on touch at the mid-dorsal and upper sacral regions. The temperature was normal, and all the bodily functions were naturally performed. He continued in much the same condition for nearly a year, a severe injury to the "spine" being made the basis of a demand for large pecuniary compensation. There was, however, neither history nor sign of lesion in any central structure, and the whole condition was regarded as one of neurotic disturbance, which might be very much controlled if the patient would only choose to exert his will. This view of the nature of the case received strong support from his previous history. He had been in a railway collision twelve years before. He then received no bodily injury, but he was very nervous about himself, and four months afterward began to suffer from spasmodic wry-neck, which lasted for four months, and which recurred again for a short time after an interval of two years.

There was no reason in this case to attribute any want of *bona fides* to the man in the presentation of his symptoms, although the largeness of his claim and the sequel of his case would rather tend to throw doubt upon its perfect genuineness. When compensation was settled he very speedily lost all the spasms and returned to work, and it was even said by one who had taken a friendly interest in his case that he had recovered with indecent haste. But his recovery, in my judgment, was due rather to the fact that settlement of his claim enabled him to make the requisite effort to do some work, and that healthy occupation provided the means of diverting his attention from himself and his ailments, so that the spasms were unconsciously forgotten and forthwith disappeared. Five

years after the accident the report ran that he was in good health, although he had been shaky and nervous for some considerable time after his claim was settled.

Both these cases present examples of undoubted predisposition to neurotic disturbance. It is impossible to say why the disorders should have assumed the forms they did, but it is interesting to note that in both of them there was a genuine dread of spinal injury, and that in the second case the wry-neck after the former accident, and the chorea-like movements of the arm and head, after an interval of no less than twelve years, were disturbances of the same kind. The cases, moreover, show of how much importance it is to know something of the previous history of the patients, and their special liabilities to disease, in order to arrive at a correct diagnosis.

Case XIX.—*Shock to Nervous System—Hysterical Seizures Beginning in Syncope.*—R. C., aged thirty-nine, an officer in the army, was in rather a severe collision at night. He was awake at the time, and was thrown backward and forward in the carriage. He had no knowledge of being hurt, and helped the stoker, who was much injured. He then finished his journey, the "excitement," as he supposed, "keeping him up." The next morning he felt very ill and vomited, and he soon began to suffer from pain across the loins, queer sensations all over the body, nausea, giddiness, and want of sleep. On the third day he took a long journey of several hundred miles to be with some friends; and on the twelfth day after the accident he suddenly fell and struck his nose against the corner of a table. He soon became conscious and screamed violently. To use his own words: "The fit came on about three in the afternoon; I fell down and screamed, and then began to cry and sob violently. During it I was unconscious, although I knew that people were around me, and that I must use all my efforts to restrain myself and to keep quiet. When all was over, I did not know what had happened." He called this fit an "hysterical attack," and the doctor who saw him immediately afterward, and who found him more or less unconscious, thought that this was its nature. Six weeks after the accident he complained of pain in the back, loss of memory, inability to apply himself, occasional giddiness, nausea, and want of sleep. He looked anxious and worn, and his doctor,

who had known him for some time, said that he was undoubtedly much changed in manner and appearance. He had lost flesh, but all the bodily functions were natural. He described the fit in the words which have been given, and said that he had had two or three since, though not so violent as the first. A few minutes after this I had the opportunity of seeing him in a fit. It had begun with screaming, and he was found lying on the sofa with his eyes closed, his face very pale, and a small pulse. He took no notice of my entry into the room, but occasionally sighed. Asked how he was, he opened his eyes and looked wildly about. He was then very sick. After vomiting he roused himself, asked how long I had been there, and said he was better. Before leaving him he was apparently asleep. Within the next two months he had three or four attacks of the same kind, though of gradually lessening severity. His claim was settled six months after the accident. Twelve months afterward he still suffered in a slight degree from the effects of the injury, but it did not prevent him from attending to his work. No later record than this can be obtained, that six years after the accident he was still on active duty. It has some bearing on the history that this patient wrote repeated, and what might almost be called "hysterical," letters about his condition and future prospects, and that he made an enormous claim, thrice the amount which he ultimately received, without resort to litigation.

Nothing is known of this patient's previous history, other than that he had always enjoyed good health; and it is worth asking, what was the origin of these hysterical seizures? It seems to me that in all probability they began with syncope, which was a direct result of weakened cardiac power from the nervous shock, and that they assumed the form they did from the very fact that the accident had produced a profound impression on the patient's mind. He was reduced to a condition in which he was ready to be alarmed, and when, after the fainting, he became partially conscious upon the floor, he screamed hysterically in very natural and increased fear. And each subsequent fit began in the same way, by a sensation of syncope—not perhaps amounting to actual fainting—which by the alarm it caused him at once determined the screaming and sobbing which were characteristic signs of each attack.

With returning strength and cardiac tone the seizures lessened in frequency and severity, until they came to an end. In other words, the sensations induced by syncope provided a suitable and adequate "suggestion" for the attacks from which this man suffered. Just as a blow on the shoulder may cause sensations which provide the suggestion for palsy of motion or sensation in the affected arm, so in disturbances which are apparently more purely psychical in character, there is need of some suggestion which shall determine the particular disorder manifested in any given case.

A like explanation seems to me to account for such a symptom as continued vomiting, the origin of which is otherwise obscure, and which may be erroneously regarded as due to some grave central or other disease.

Case XX.—*Nervous Shock—Continued Vomiting.*—A healthy woman, aged twenty-nine, the mother of one child, was in a very slight collision in shunting. She was thrown suddenly forward, and a box fell from the rack and inflicted a minute punctured wound on the left frontal eminence. Until she felt the blood trickling on her forehead she did not know she had been hurt. An hour and a half after the accident, when she arrived at home, she vomited, and from that time onward vomiting followed immediately upon each attempt to take food. Never at any time was there the smallest indication of injury about the stomach. Four days after the accident she had an attack of acute hysterical laughter and crying, and in the course of the next four weeks attacks of a like character were repeated several times. She complained of shooting pains in the neck and head, and of pain, hyperæsthesia, and tenderness over the dorsal region of the spine. Nevertheless there was no spinal rigidity, nor any difficulty in moving her limbs. When I saw her a month after the accident, no evidence of local injury was anywhere discoverable, but her pupils were sluggish and wide, the knee-jerks were decidedly exaggerated, and there was well-marked though not sustained ankle clonus, such as is frequently seen in similar cases of so-called functional neurosis. The vomiting was still going on, but without pain, and with a perfectly clean tongue. All this time she had been in bed, and had become extremely weak. There was no rise of temperature.

A new line of treatment was now begun, the object of it being to improve the nutrition, by often repeated small quantities of milk or other light food; and if possible, by the smallness of the amount taken at a time, to baulk the vomiting habit. The lapse of another month saw a considerable improvement in her nutrition, she was able to be up and out of doors, the pupils were smaller, the knee-jerks were within the normal range, and the ankle clonus had entirely disappeared. There was not, however, any great improvement in the vomiting, for an endeavor to take an ordinary meal immediately made her sick. The reason for this was not far to seek. The patient had now become an object of special sympathy in the village, and her only return for the bounty of her neighbors, both rich and poor, was to go on vomiting. One thing was now essentially called for in order to bring about her recovery, and that was isolation from her friends. Accordingly she left home, was placed in the charge of a nurse, and treatment suitable for her condition was forthwith begun. It would be untrue to say that she never vomited again, because in the course of the next three months she did vomit twice, and twice only, in the old purposeless way; but this may be said, that her convalescence began from this time, and that she ultimately, within nine months of the accident, was quite well.

This case is, to my mind, a very instructive one. Almost uninjured at the time of the accident, it is certain that there must have been an amount of shock sufficient to cause the vomiting within an hour and a half, and the psychical effect was indicated by an outbreak of acute hysteria on the fourth day. The reality of the nervous disturbance was shown, moreover, by the increase of the knee-jerks and by the ankle clonus; and a vicious circle was quickly established—malnutrition affecting the nervous centres alike of brain and cord, whose condition in turn made the act of vomiting more easy and more durable in the absence of some physical cause. There never was any question as to the nature of the case, and it seems to me that there can be as little doubt as to the origin of that one symptom which was its especial feature. The initial act of vomiting gave the suggestion for its continuance to a sensorium profoundly affected by the circumstances of the accident. And it is abundantly obvious how a recogni-

tion of this sequence of events was essential for the adoption of the line of treatment which speedily ended in cure. Had this patient stayed at home, and been treated on the supposition that she had some serious organic disease, the result would surely have been different. I have now had under occasional observation during the past eight years the case of a young man whose symptoms were not unlike those of this woman. He had been very severely shaken in a collision, and there was much shock, out of all proportion to the physical injuries sustained. Vomiting came on within twenty-four hours, and has continued ever since in varying degrees. Repeated examinations have failed to discover any organic cause for it either in the stomach itself, the peritoneum, or the nervous centres, disease in one or other of which would in all probability have shown itself in this length of time. By a process of exclusion, therefore, the diagnosis points in the direction of the last case, but neither his own medical attendant nor I have been able to persuade him to submit to treatment by isolation. His case is of value as an illustration of the fact that settlement of claim does not always work for a patient's recovery. (In Dr. Bristowe's "Diseases of the Nervous System," p. 40, is an interesting lecture on "The Functional Vomiting of Hysteria," in which he relates a case of vomiting which lasted between two and three years, and which dated from a voyage made across the Atlantic. The author doubts whether food ever reached the stomach, and whether there was not some functional affection of the œsophagus.)

We may pass on now to say something of hemianæsthesia, surely one of the most remarkable indications of cerebral disorder. The text-books of medicine and of nervous diseases contain such full accounts of this strange condition, of its many vagaries and its accompanying disorders of the special senses, that there is no call to describe it here, and I shall content myself with a few remarks upon particular cases, choosing those of men for consideration.

Case XXI.—*Hemianæsthesia and Hemiparesis, following Hypnotic State from Fright.*—A highly neurotic but otherwise healthy man, aged forty-seven, was bruised in several places, head, neck, and buttocks, by being thrown suddenly backward and forward in a railway collision of no great

severity. He instantly lost consciousness, and so remained for two hours. On arrival at home his doctor was sent for immediately, and found him suffering from left hemiplegia in addition to great emotional disturbance, crying and sobbing. No examination was then made as to sensation, but two days afterward he was found completely anæsthetic on the same side, and all the corresponding special senses, hearing, taste, sight, and smell, were likewise affected. There was also loss of muscular sense, impairment of the sense of color, and spasmodic deviation of the tongue. The knee-jerks were increased, and there was slight ankle clonus. When I saw him three months afterward the various symptoms were much diminished in degree, and there was no longer any deviation of the tongue. Though able to walk and even get down-stairs, his gait when under observation was singularly slow and labored because of inability to use the left leg, the movements of which were now made in one way and now in another, there being nothing specially characteristic about them. The whole muscular system was extremely flabby, but there was no wasting of one part more than another. The man's aspect was suggestive of great mental depression, but he acknowledged that he was somewhat better than he had been. He has gone on improving, but it is impossible yet to give a complete history. The case is nevertheless worthy of note as it stands because of the early onset of the symptoms, and from the fact of the man having immediately passed into that state of daze or unconsciousness which seems to be so important a factor in their development. There is no reason to think that his unconsciousness was the unconsciousness of true brain concussion, for there was no local blow sufficient to determine a state of coma of two hours' duration, and the condition was more probably that which is due to fright alone. Why in this particular case the so-called functional disturbance should have shown itself in hemiplegia and hemianæsthesia it is impossible to say, just as no reason can yet be given for hemianæsthesia being more common on the left side than on the right. The loss of sensation was in all probability as early a phenomenon as the loss of motor power, both ensuing upon the hypnotic state which was an immediate effect of the accident. In another case the hemianæsthesia was detected on the day after the accident.

Case XXII.—*Hemianæsthesia, etc., etc.*—A man, aged forty-three, of neurotic temperament, was in a very trifling collision, which jolted him, however, from his seat and deposited him on the floor of the carriage. There he found himself, and was subsequently unable to give any better or more explicit account of what happened to him. There was no evidence, however, of his having been hurt bodily, and he went to his business next day. He soon broke down completely, and a doctor who was sent for found him in a semi-dazed condition, and proceeded immediately to examine the state of cutaneous sensation. It was absent on the whole right side, and was accompanied, as in the last case, by some loss of power in the right leg. There were also present in an extreme degree the usual affection of the special senses, loss of muscular sense, and spasm of the tongue. With it also were many neurasthenical symptoms, coldness of the limbs, especially of the right leg, occipital headache, loss of sexual desire, and widely-dilated pupils. Occasionally also he had hystero-epileptic seizures. For many months there was little or no improvement, and at the end of a year, during which he had led the life of an invalid, and made no attempt to work, the hemianæsthesia still continued. His claim was finally settled, but whether that put an end to the anæsthesia or not I am unable to say. I think, however, it is highly probable, for it put an end to the "suggestion" of it in frequent medical examinations; and this is certain, that the man very soon resumed his ordinary mode of life, and within nine months gave every indication that his bodily health had been restored.

I do not for one moment wish to convey the impression that this case was not a perfectly genuine one. There was, of course, no doubt as to the existence of the hemianæsthesia and the accompanying phenomena, but from beginning to end of its long history it was an example of the injurious influence which the matter of compensation, and dawdling about at home, have in cases of the kind. Hemi- or any other distribution of anæsthesia is a valuable indication of the nature of any given case. It is an expression of an abnormal cerebral condition, and, whatever may have been its origin and exciting cause, there cannot be anything much worse for a patient than to have the symptom, if not revived, at any rate kept

alive, by repeated examinations, which are made either from genuine interest in the case, or in preparation for an action at law. I have pointed out on an earlier page how movements which fail from failure of the will to make them may, nevertheless, be automatically performed. The conception of something of the same kind is much more difficult in the case of sensory than it is in the case of motor power, but one could hardly go as far as to say that it was impossible for common sensation to be within the range and influence of what is termed will. The receptivity of the sensorium for impressions which reach it from the periphery may likewise be both voluntary and automatic; and the history of some cases inclines me to think that a person may acquire the power of inducing anæsthesia, much in the same way as by practice he may induce the repetition of motor phenomena which are close imitations of real disease. At all events I do not think that hemianæsthesia, real in itself though it be, can be regarded as outside the category of those cases to which the following quotation from Dr. Wilks is more or less applicable: "I do not look on hysteria," he says, "as a fictitious disease or a sham; the condition with all the phenomena is real enough; at the same time the hysterical state is so often associated with some moral obliquity that it is very difficult to say how far a particular symptom is feigned or exaggerated" ("Diseases of the Nervous System," p. 55, 2d edition). He records a case of gross imposture, in the history of which a pilgrimage to Lourdes played a conspicuous part, hemianæsthesia being among the man's symptoms.

It would be wrong and most unjust to say or to suggest that moral obliquity is an attribute of all persons who present hysterical symptoms, yet, even where there is a condition such as hemianæsthesia, the possibility of a certain amount of conscious influence over the chief symptom must be borne in mind.

Case XXIII.—*Hemianæsthesia, etc.—Doubts of Perfect Genuineness.*—A man, aged fifty-one, was in an altogether trivial accident, in which, if he was injured at all, he sustained a slight sprain of his posterior cervical muscles. He did not know he had been hurt until the night after the accident, when he woke with a start, and the next morning he felt shaky and nervous, and was unable to write a letter. He took to

his bed, and after he had been there for a week he was examined by a surgeon, who observed such inconsistencies in his statements and symptoms as to lead him to regard the case as not perfectly genuine. When I saw him myself a month afterward there was left hemianæsthesia, and some weakness in motor power also. There were spasms during examination of the shoulder and neck muscles of the left side, and certain movements, such as squeezing with the left hand and putting out the tongue, he professed himself unable to perform, although neither in his speech, nor in ordinary movements of the limb automatically performed, was there any sign of paralysis. The special senses were also affected in the usual way. After an interval of two months there was slight, but only slight, improvement. How long this state of things lasted it is impossible to say, because renewed requests that the man might be seen by surgeons for the railway company were refused on the ground that he was far too ill to allow of any examination. An exorbitant claim was presented, and the case went to trial. It was then conclusively proved that during most of the time when he was too ill to be examined, and was wholly unfit for anything except confinement to bed, he was deceiving his own doctor, and was leading a life of very considerable enjoyment—after dark. In fact he loved darkness rather than light. No good purpose can be served by giving in detail all the facts of this case—let them be recorded by his own advisers, legal and medical; but this may be said about it, that the accompanying exaggeration and imposture were such as to throw very grave suspicion on the perfect genuineness, not on the perfect reality, of the symptom hemianæsthesia. And in endeavoring to come to a right conclusion as to the value of this symptom in any given case there is an error, I feel sure, to be avoided in looking upon hemianæsthesia as a thing which stamps a case at once as genuine simply because we cannot say how it is induced. *Experto crede.*

The record of two cases will now be given where the hypnotic condition was even more marked than in any which have preceded. In both the patients there was a history of previous psychical disturbance, and there was insanity, moreover, in their families. Both, I believe, were predisposed to suffer from neurotic disorders should any adequate cause arise.

Case XXIV.—*Hypnotic Catalepsy, etc.*—B. A. B., aged thirty-six, a strong and active man, was in a railway collision at night, in which a large number of persons were more or less injured, though the accident was not severe. He complained shortly afterward of having been shaken, and also that his back had received a wrench, owing, he thought, to his sitting sideways when the collision occurred. He had one or two slight bruises on one arm, and a sprain of one wrist. For the first few weeks after the accident there were no symptoms of constitutional disturbance or of serious injury, but the man said that he could not hold himself upright or walk any distance in consequence of the injury to his back, and the doctors who saw him thought that he was to some extent exaggerating the effects of his injuries. About five weeks after the accident he suddenly changed. He constantly repeated that he was going mad, and that he was sure he was going to be paralyzed. He began at the same time to take violent exercise, walking several miles a day at great speed. This was followed by great exhaustion, during which he was "wandering and hysterical," and there ensued attacks which were described by a medical man who saw him as "hysterical mania." These continued for several days. The state which followed next can only be described in the words recorded at the time. "He is lying in bed on his right side with his knees drawn up. There is not the slightest movement when he is spoken to, or when he is touched through the bed-clothes. There is a continuous quivering of the upper eyelids. Asked to put out his tongue, there is no response, though when the lips are pulled apart he seems to make some effort to open the jaws and protrude the tip. By raising the lids the pupils are seen to be equal in size, and they react normally to light. The aspect of his face is that of complete repose and disregard, but he is obviously not entirely unconscious. Pulse 56. His arms and hands remain in any position in which they are placed. The arms and legs are very much wasted, and the whole body seems emaciated. The legs are at once drawn up spasmodically on tickling the soles, and pinching the calves evidently causes pain, for he groans and much contorts his face. On touching any part of the chest or abdomen rather firmly with the fingers, the whole body, face, and arms are spasmodically worked, the legs being frequently abducted and

adducted. The abdominal muscles are almost as hard as a board." He is said to have occasionally an "hysterical fit," consisting of spasms all over the body, beginning with an expression of fright, and lasting about fifteen minutes. An experienced nurse attending him says they are not like epileptic fits. He takes plenty of nourishment, milk and beef-tea, but little or no alcohol. He passes water only once within twenty-four hours, sometimes groaning beforehand as if in sign to the nurse. The bowels are never moved without enema. He lies for hours absolutely motionless, and three weeks ago he never moved a finger for a whole day, nor passed water once. A serious feature in the case is the great wasting, food, although taken in abundance, seeming to have small influence in maintaining the bodily nutrition, and he looks as if he might sink and die. This condition lasted for about six weeks, and then under the influence apparently of larger doses of alcohol—the increasing exhaustion and wasting having seemed imperatively to call for it—he began to emerge from the state in which he was, to move in bed, to open his eyes, to take more solid food, and even to speak a little very feebly. He was soon able to get up and go about, made flesh again rapidly, and took some exercise. He was, however, very nervous and apprehensive, and felt sure he should never get well. Seven months after the accident he still complained of his back, and held himself in a stooping posture. Questions were answered very slowly, and any required act, such as that of putting out the tongue, seemed to demand an unnatural effort. From this time he continued to improve, and in eight months he was so far well that it was thought right and prudent to allow him to arrange his compensation.

It bears upon the case that the claim was by no means large, and there was no reason at any time to believe that the matter of compensation was unduly affecting the patient's mind. Of far greater importance is the fact that there was a strong family history of insanity. His father and one uncle were "queer," a brother had actually been in an asylum, and his sister is very hysterical. His own account of the condition in which he lay so long is, "that he knew all that was going on around him, that he remembered when the doctors came, and knew always when there were more of them than usual,

but that he could not speak, and supposed that his brain would not direct him to do so." The sequel of the case is satisfactory, the following report of him being obtained two years after his claim was settled, or thirty-three months after the accident: "His recovery was gradual, but without any relapses. He married six months after his claim was settled, and has one son about two months old. He has had no illnesses, is at present strong and stout, and is emigrating some time this month."

It is impossible to conceive that the symptoms in a case like this could have been in any way dependent upon injury to the spine, and this much may be said of it, that, when this strange condition supervened, all thought of injury to the spine as a cause thereof passed from the minds of those who were attending him. The man, indeed, himself had shown, by the violent bodily exercise which ushered in the mental disturbance, that there really was no sign of paralysis or even weakness in the legs, and that the pain in the back was very slight indeed. The condition was essentially one of profound mental disturbance originated by shock, immediate fright, and the fear of impending evil, in a man with a strong family taint of insanity. The higher cerebral faculties seemed for the time to be in that state of slumber which has been mentioned, and his general condition was very like that described by Heidenhain and others as occurring in the so-called mesmeric or hypnotic state, and associated with cataleptic phenomena. (Writing of the disturbances of the motor apparatus which have been observed during hypnosis, he says: "More or less extensive cataleptic rigor becomes established; the limbs thus affected remain in any imaginable position they are placed in. The will has, it is true, not wholly lost influence over them, but it is exerted with very great difficulty. If, however, with a great effort, the parts be set in activity, there often results, instead of simple, convulsive movements which spread to other parts of the body."—Op. cit., p. 77.)

Case XXV.—*Hypnotic Catalepsy—Delusions.*—Almost exactly parallel with the last case is that of a strong and healthy man, aged thirty, who was in a collision, and who presented the usual signs of having received a sprain of his back and some general shock to his nervous system. He lay

for long in much the same hypnotic state as the last patient, alternating with fits of violence and passion. When he awoke from this, he became the subject of a delusion that he was being poisoned, and was accordingly removed to an asylum, about ten months after the accident. He remained there six weeks; and while an inmate he adopted a peculiar gait, which lasted up to the time when his claim was settled, two years after the accident, and which formed the ground of a very serious view that he had received a permanent damage to his spinal cord. His mode of walking was thus described when he came out of the asylum: "He puts the weight of his body on two sticks placed in advance of him, and draws each leg alternately forward with the foot much everted. When about to advance one leg he twists the other inward on the toes, so that the latter points forward instead of outward. He keeps the knees quite stiff. In this way he shuffles along with great rapidity. As he stood with his back against the wall, he was asked to lift up his knee, but he professed utter inability to do so." Very careful examination was made at this time as to the nutrition and state of the legs, and a report shortly afterward ran thus: "The reflex irritability and faradic excitability of the muscles of the lower extremities are normal; there is an entire absence of affection of the bladder or rectum, or of any trophic change, such as muscular atrophy and bedsores. There is also an entire absence of muscular tension, rigidity, contraction, or deformity in the lower limbs. Examination did not enable me to determine whether any affection existed on the sensory side, as the patient absolutely refused to answer any questions. On the whole, my opinion of the case is that it is an example of many recorded instances, in which a slight and unimportant injury develops various emotional and hysterical symptoms." At a final visit made to him before his claim was settled, he complained more than ever of pain in his back, and called out loudly when touched upon his clothes. While sitting in his chair he could move his legs in any direction required of him, though much persuasion was necessary to get him to move them at all. He suddenly vomited without any precedent sign of nausea or retching. Asked to walk across the room, he essayed to do so after much persuasion, and walked in the manner already described. There was no tremor of the legs during progression, and

nothing like ankle-clonus or the gait which is seen when there is secondary degeneration of the cord. Subsequently, on being asked to go into the next room, he began to do so, but almost immediately fell down flat on the floor, whence he was lifted and carried away. A very large claim for compensation was preferred, and was arranged two years after the accident, not, however, without a resort to litigation. He shortly afterward left the house in which he had been living, and for some time it was not known where he was. Forty-two months, however, after the accident, he was fortunately seen by one of the medical men who had visited him during his long illness, and he found him in perfect bodily health and vigor, and the father of another child. It should be stated, as having an important bearing on the case, that the man's previous history was bad. He was always very irascible, and some years previous to the accident he had been laid up with sunstroke. There was also some doubtful history of insanity in his family.

It will not be thought that this case has been mentioned unnecessarily, when it is pointed out that pain in the back was throughout a prominent symptom, and that it was considered by some to be a case of severe injury to the spine. From the first moment, indeed, treatment was specially directed to his vertebral column, and a most careless examination of the urine, which was found to be feebly alkaline after it had been standing for some time, seemed to lend support to the diagnosis that there had been injury to the spinal cord.

It need cause no surprise that there were wide differences of opinion as to the nature of this case. "Shamming," on the one hand, to sclerosis of the lateral columns, preceded and originated by a meningitis, on the other, formed the two extremes. The truth lay between them, and that opinion proved correct which held that it was essentially a case of functional disturbance, and that as there was no special reason or symptom to place any lesion in the spinal cord, the man would in all probability get perfectly well. The previous history of the patient showed that he was liable to serious psychical disturbance, but it is only right to add that the motive in this case for maintaining the neurotic state was exceedingly strong. Control might have been exercised, I believe, by this man far

more easily than by the previous patient, and the representation of many of his symptoms was not very far from being wilful. Since this case was originally described, the man has been in another accident, and in support of his claim for compensation he again adopted the peculiar gait which has been described. He carelessly forgot, however, to keep it up on all occasions, and the early settlement of his claim was a direct consequence. As to this particular symptom in the case no more need therefore be said. Some parts of a case may be genuine but not all, nor does a real psychical disturbance enable a man the better to resist the temptation to invent or exaggerate symptoms in view of a pecuniary claim.

Glancing finally over the cases mentioned in this chapter, the number of which might have been multiplied almost indefinitely, it has to be noted that the physical severity of the accident or the bodily injury has obviously but little to do with the symptoms which supervene. Nothing is more certain than this, in searching for a cause of the symptoms, that it is not in bodily injury that the cause is to be found. One man may be hurt in one way, another in another, many are not hurt at all, but the symptoms have all a common cause, best and most comprehensively expressed in the one word—fright. And varied though the symptoms may be, they are the manifestations of a fright neurosis. This also is the burden of the teaching of Oppenheim in the work to which reference has been already made. In his experience, however, and in his view psychical disturbance and change, amounting almost to insanity, have a more prominent place in the history of his cases than has been my own experience, or is to be met with in the description of cases in the English tongue. Thus, in one place we find him speaking of anxiety growing into a real pathological entity, and of the great majority of the cases falling into a distinct category of traumatic neuropsychoses. He is satisfied neither with "traumatic hysteria," nor with "traumatic neurasthenia," as suitable terms to describe the cases which he has himself had under observation. I do not, however, think that "neuropsychosis" is a term altogether applicable to the majority of the cases seen in this country, and I am inclined to believe that there are three main types of functional nervous disorder following injury—the hysterical, seen in France; the psychical, and more mark-

edly hypochondriacal, seen in Germany; and the neurasthenical, seen here. So much, however, depends on the way in which cases of this kind are looked at, that it would be no surprise to me were Oppenheim to see in a hundred English cases typical examples of his own neuropsychoses; Charcot in a hundred German a vast amount of hysteria; and an English observer both in French and German cases many symptoms indicative of neurasthenia. All are, I believe, describing the same thing, and neurasthenia, it must be remembered, is itself a functional nervous disorder through and by which many symptoms arise.

At any rate, if the cases described by Oppenheim are examples of the cases most frequently met with in Germany, the type in that country differs, it seems to me, from the type in this. Not that cases of psychical disorder are not met with here, but that they are far less common than in that country. In some of the cases in my own experience the symptoms have been originated by something more than fright, and there has been a clear history of concussion of the brain, while in others the evidences of nerve prostration or general neurasthenia have been especially prominent. Thorburn relates the case of a woman with left hemianæsthesia (op. cit., p. 196) following severe shock and bruises in the Hexthorpe collision, of whom he writes: "Her mental condition was remarkable. She had an intensely frightened 'scared' look, like that of a wild animal. She paid little or no attention to her surroundings, and it was with the greatest difficulty that she could be got to answer even simple questions. She was quite incapable of connected speech, but there were none of the emotional manifestations usually regarded as hysterical." A year later this condition had passed away, although there was still some impairment of sensation. Commenting on the case, he says that beyond the hysterical hemianæsthesia, there was for a time a profound mental change also of hysterical origin.

The same writer describes a case of hysterical melancholia with occasional suicidal impulses. The man, however, had never attempted to follow them out, and when his claim was settled he improved. In a case quite recently under my own observation, in which there were symptoms of extreme neurasthenia, the patient, a man aged thirty-three, suffered for some weeks from the greatest mental depression, had visions of horrible faces before him at night, and suicidal impulses

which led him—himself—to take care that he was never left alone. Thus protected, he never made any attempt on himself, and when his strength began to return, all thoughts of self-destruction passed away; but so overpowering was the sense and the remembrance of his mental depression that, weeks afterward, he said he wished that he had really committed suicide. This man had been in a very severe collision, and was bruised in many places, but it was not until three hours after the accident, when he was far from the scene of it, that he became unconscious. And on this there ensued the symptoms of nerve prostration, together with slight hemian-æsthesia of transient duration, and the mental symptoms which have been named. Six months after the accident, when he was beginning more rapidly and decidedly to improve, he still had an expression of the intensest anxiety, as if he had passed through something very terrible. I do not propose to dwell longer on this class of symptoms, because the type of case to which they belong is certainly not common in this country. The reader must therefore turn to Oppenheim's work for information on the subject.

These symptoms of mental disorder seem to me to emphasize in a special manner the fact that most of the results of railway injury are essentially psychical in origin. Belief in their reality is certainly not lessened by the fact that, in Oppenheim's experience, many of the sufferers were not in a position to claim compensation for the injuries they had sustained; and at the same time it will not be questioned that the symptoms of mental disturbance may be readily increased and kept alive by those very things which, in the case of other symptoms, are so prone to work prejudicially and to retard recovery. A very great deal depends also on the manner in which the various complaints are regarded and observed, and no one will deny that the creation and development of all sorts of symptoms may be readily induced, when patients are in this condition, by leading questions which suggest them to their minds.

CHAPTER VI.

ON TREATMENT.

I PROPOSE in this chapter to make a few collective remarks on the principles which should underlie the treatment or general management of the various cases which have been considered. It has been pointed out that compensation very frequently exerts an injurious influence on the clinical history of railway injuries, and it may at once be said that were there no question of compensation the treatment of them would be decidedly easier than it is. An endeavor, however, must be made as far as possible to keep this matter in the background, and to discuss the subject of treatment on the assumption that our patients are anxiously desirous to get well, and to have the best that can be done for them in order to promote recovery.

First of all, as to those spinal injuries, which we have seen, in the great majority of cases, to consist of sprains of muscular and ligamentous structures. The two conditions which have to be remedied are pain and stiffness, and care has of course to be taken that no harm shall ensue from the treatment adopted. Diagnosis is, therefore, all-important, and it is essential, by a very careful examination, to make sure that the injury is not of a more serious nature than usual, for the line of treatment which is necessary for the removal of stiffness would be that which above all others is objectionable in the case of osseous or meningeal injury.

Rest and warmth are, in the early stages, the two things most conducive to relief from spinal pain; rest by reclining in bed, warmth by the continuous application of hot fomentations or poultices. In every case, the question has to be considered, "How long ought a man to stay in bed?" and the answer to it must very much depend upon the severity of the injury, on the character of the pain, and the extent of the

spinal column which is involved. There are very few instances, however, in which the patient should be longer than three weeks in bed, and in many it is decidedly advantageous that he should be up much sooner. For the longer he is at rest upon his back—and the rest, be it remembered, is simply to allow time for the complete resolution of the subcutaneous injury sustained—the more likely is it that he will suffer from spinal stiffness afterward. This is what we are wont to see in the case of sprains in the neighborhood of the joints of the limbs, and there is nothing in the case of spinal sprains to exempt that part of the body from like consequences. The man must be up and move about; and gentle gymnastic exercise each day, such as he himself can make at home, will do much to prevent the increase of spinal rigidity, and to remove that which is already present. Here, however, comes in the difficulty, that the pain which is sure to follow the first movements made will be to his mind an unanswerable reason for not moving any more. Compensation is likely to support him in this resolve, and all attempts to get him to move about are likely to be frustrated. The stiffness increases, and is more incapacitating, and it becomes essential, perhaps, to adopt some more definite and vigorous treatment. Massage, it is well known, is of inestimable value in the treatment of sprains and other injuries in the neighborhood of joints, and recently the practice has been advocated of treating sprained joints, and even fractures in the neighborhood of joints, by immediate massage without a preliminary period of rest. The same treatment is to be recommended for the stiffness of a sprained spine, but it must be systematically carried out, care being taken throughout that no undue strain be put upon the system generally, should the bodily nutrition be below the natural standard of health. Especially has this to be remembered in those cases where the spinal pain, with its accompanying stiffness, is the result of weakness rather than of any injury sustained. The weary aching of myalgia, which is prone to arise in all cases of prostrating illness (and we have seen how common is general bodily and mental prostration after railway accident), is not to be remedied by the vigorous manipulations of the masseur, unless something be done at the same time to improve and build up again the general bodily nutrition. This method of treatment is usually more

satisfactory in its results than that of faradization of the muscles on either side of the spinal column, although both in this manner, and in the galvano-faradization recommended by De Watteville, there are powerful means for improving the muscular nutrition, calling muscular fibres into action, and so relieving the stiffness. What is wanted is to get some of the muscular fibres which have been disused into action, and if by any chance there has been adhesion of neighboring ligamentous fibres because of the sprain, movement is imperatively necessary to start the reparative process. Thus it is that ironing the back with an iron as hot as can be borne is frequently an admirable remedy in these cases. The warmth is good in itself, the friction stimulates and restores the local circulation both of capillaries and lymphatics, and the application of great heat to the skin makes the patient shrink and move, and so calls fibres into action over which he has no voluntary control. I am altogether opposed to the treatment of these spinal sprains by the application of spinal jackets; they merely postpone to another day the treatment which will have to be carried out, and they moreover tend to increase the rigidity, and make the ultimate treatment more wearisome and difficult. Cumbrous in themselves, they do little but harm. Nevertheless, it is certain that patients sometimes find relief when they begin to go about again from wearing a belt, for it gives support to, and provides warmth for, a part which has the sensation of weakness. Relief also may be given sometimes by wearing a plaster over the loins, belladonna or other; but as a matter of fact the best relief of all comes in time from daily exercise and leading the same life as before. A neurotic, gouty, or rheumatic history and inheritance are prone to make all these cases troublesome, and any special element of the kind should never be ignored in considering the question of treatment.

While, however, the vast majority of the cases with which one has to do are either cases of simple sprain or myalgia from a lowered condition of the general health, the comparatively few cases in which there is more serious injury outweigh all the rest in importance. If we are convinced, by the abiding character of the pain or by the involvement of a nerve trunk, that there is inflammation, perhaps with synovitis, of a small spinal joint, or some local meningeal thickening, then

it is very obvious that a wholly different line of treatment must be adopted. Rest, local rest, must be rigidly enforced, and such help in the absorption of inflammatory products as is likely to be given by local counter-irritation must not be neglected. Further, if there be any suspicion of syphilis, influence must be brought to bear on that element in the case by those special remedies with which all are familiar. Above all things, it is important that the patient be kept under careful observation.

Passing now to the symptoms which frequently accompany spinal sprain, but which are nevertheless independent of it and are often found alone—those symptoms which are collectively indicative of neurasthenia—the essential line of treatment to be adopted is to keep up the bodily nutrition. A word, however, may first of all be said about the medicinal treatment of these cases, emphasizing at once and decisively that there is no specific remedy. We all know how much of fashion there is in medicine, and in the days when bromide of potassium was administered for almost every form of nervous disease it was the custom to fly to bromide, under the impression that a sedative was essential to quiet the nerves. In the early stages of severe mental shock, with its sleeplessness, general nervousness, and agitation, it is certain that bromide of potassium occasionally brings considerable relief; but although every one can take a casual dose of bromide without harm, the continued taking of it is likely to be most injurious. And in my former work, as well as in a special clinical lecture on the subject ("The Abuse of Bromide of Potassium," "Medical Times and Gazette," Vol. I., April 4th, 1885), I ventured to point out how much, and how often, harm had been done in the management of these cases by the administration of bromide of potassium in frequent doses over long periods of time. And it is absolutely true that the convalescence of many patients has only begun when the bromide so administered has been withheld. The symptoms of bromism, be it remembered, are essentially those of general depression both mental and bodily, irritability of temper, a continued feeling of exhaustion and incapacity for any work, intellectual dulness and loss of memory, a sense of utter feebleness, a tendency to be despondent and to cry, and loss or impairment of sexual desire. These, it will be recognized, are very much

the symptoms of general nervous exhaustion after railway collisions; and it is certain that the continued administration of bromide of potassium is likely to do them harm, and seriously prevent their removal. As Dr. Anstie pointed out many years ago, it is only those who are in vigorous bodily health who can bear its prolonged administration. It is the potassium which is the injurious element in the salt, and if it be merely desired to produce sleep and quiet let the bromide of sodium or ammonium be given in preference.

One of the greatest and most frequent difficulties in these cases is to procure sleep, and the whole round of the Pharmacopœia may be almost gone through without success. Of opium compounds the bimeconate of morphia is often the least injurious, and sulphonal and chloral, with or without bromide, are sometimes useful. I have no faith, however, in any one remedy, nor is any one infallible. The patient is often much better without them, and if he sleeps much or little during the day there need be less concern as to his not sleeping at night, provided that at night he is not left alone to work himself into a state of nervousness, agitation, and fear. Alcohol is of little or no use in these circumstances, and it may be said, once for all, that patients with the symptoms of general nerve prostration can rarely bear it. In the majority of cases, however, it is not the want of sleep which is so harmful, but the want of food.

It has already been pointed out how often disturbances of digestion accompany the symptoms of general nervous exhaustion; they do something more than accompany, they are in themselves important signs of the condition; and it is simply an inevitable part of the condition that the patient cannot take ordinary food in the ordinary way. In a word, the notion that he can subsist on his usual three meals should as soon as possible be abandoned, for otherwise it is practically certain that he will obtain an insufficiency of food. The consequence is this, that the already exhausted nervous system is prone to become more exhausted still from the want of proper nutrition. The rapid wasting that is sometimes seen in these cases is often quite as much due to the want of food, as to any direct effect upon the nervous centres themselves. Easily-assimilable food must therefore be given in small quantities at frequent intervals, and neither at night nor by day should the

patient be long without it. Just as convalescence has frequently set in when bromide of potassium has been withheld, so also it is true that convalescence is frequently seen to begin at the moment when special attention is directed to this matter of providing adequate nutrition and food. And what follows in its train? An improved sense of bodily well-being and a diminution of the myalgia from easily-induced muscular fatigue, and, above all things, very often the return of something like natural sleep. Food is the thing to break through the vicious circle which encompasses the patient.

There is yet that other class of cases in which the voluntary taking of food is difficult, and where there is perhaps a more decidedly hysterical element acting prejudicially on the symptoms. The symptoms alone defy treatment; the patient, if the expression may be used, has to be treated as a whole. His surroundings are objectionable, and the sympathy of his friends is misdirected and injurious. Removal from home is almost an essential part of the treatment, and there are, perhaps, few cases in which the Weir Mitchell treatment in its entirety—isolation, massage, and excessive feeding—is so likely to be followed by good results. Isolation frees him from that sympathy which fosters and keeps alive the mental attitude of the patient toward his own case, and the feeding, together with the massage, provide the nutrition and the physiological stimulus of exercise of which he is so sorely in need. It is very often, of course, a matter of considerable difficulty to induce patients to undergo this treamtent, for reasons which are sufficiently obvious. Here I can do no more than say of how much benefit it is likely to be, and how eminently true this is of the cases where there is some definite neuromimetic sign of nervous derangement. Isolation will at any rate be an obstacle to frequent examination of the patient, a thing which is so prone to keep alive the manifestation of any special nervous symptom.

Be it further borne in mind that in all these cases of nervous exhaustion rest is a very essential thing in their management, and it is a matter of supreme importance that at no stage of the illness shall the symptoms be aggravated by the exhaustion of overwork. If a man has his leg broken he is of necessity doomed to rest, but it is far otherwise with the man who has not met with any physical injury such as to prevent

him from going to his work the day after the accident. He feels only a little shaken, but nevertheless it is eminently advisable that such a man should for a time rest quietly at home. I am sure that in very many cases the severity and continuance of the symptoms have been due to want of rest at first. The precaution of complete rest may wisely be adopted in all cases of railway injury, be the early symptoms never so slight; and at a later stage it is equally certain that no perfect rest can be enjoyed, when a man is worrying about compensation; just as the enjoyment and rest of a holiday are assuredly destroyed, when a man has his letters sent after him to plague and annoy him.

CHAPTER VII.

MALINGERING.

"Is the condition before us real or feigned?" is a question which we have sometimes to ask ourselves in the routine of practice. A correct answer to it is obviously of great moment to both doctor and patient; and I propose, therefore, to say something on the special kind of malingering which may be met with after the injuries, or after no injuries, received in railway accidents. It may be well, however, in the first place, to name some of the points which have to be borne in mind in the endeavor to come to a right conclusion, that we may decide whether the signs of disease before us be real or assumed, or the complaints we hear be genuine or the outcome of wilful exaggeration; whether, indeed, to adopt the classification of Ogston, the disease be feigned, factitious, exaggerated, or aggravated. It is a common experience that most feigned disorders have in them some basis of reality, or some revival of the symptoms of a former lesion or injury used again for purposes of deception. Familiarity with the phenomena and history of disease can alone, therefore, enable a man to pronounce with certainty as to the real nature of any particular disorder, and to detect the mistakes into which malingerers so often fall.

An apt illustration may be taken from the attitude and position of joints in real and assumed disease. By his loud complaints a man may wish to suggest the presence of destructive mischief in a joint, but in all probability he will go wrong in the attitude and position which he gives to his limb. Or without pretending to be afflicted with actual joint disease, a patient will sometimes affirm that a joint has become stiff, and that it is impossible to move his arm or leg. It is unnecessary to make any mention here of the recognized causes of stiffness and anchylosis of joints; suffice it that the entire absence of them, both in the history of the case and in the

course of the disease, will reveal a flaw in the evidence sufficient to raise suspicion. Suspicion grows into tolerable certainty if you are careful to observe the conduct of the person under examination.

A man complained that he could not work because of stiffness in the right elbow and inability to straighten his arm. He said he had fallen on his elbow a month before, but it was clear from his answers to questions that the injury had not been at all severe. Comparison of the two elbow-joints showed an entire absence of physical signs, and there was no wasting of the limb. Noticing, in examination, that attempts to flex or extend his arm were forcibly resisted, he was told to look in the opposite direction, questions were asked him unconnected with his arm, and there was no difficulty in bringing it at once to natural and full extension. A turn of his head and eyes toward the affected limb was immediately followed by active flexion to the original degree. Complete flexion also could be produced under like circumstances. Examination of both arms simultaneously seemed to confuse him, for he called out with pain when pressure was made on the sound limb. Such inconsistencies as were met with here ought, at any rate, to place us on our guard. A man based a large demand for compenstion from a railway company on stiffness of his elbow and inability to move his arm, the result of a collision. A verdict incommensurate with his expectations having been recorded, he threw up his arms and exclaimed, "My God! I'm a ruined man."

Furthermore, an impostor may adopt devices to produce conditions, which, in themselves alarming, are yet seen to be without significance when every feature of the case is examined. A prisoner took to his bed complaining of great pain and swelling of the abdomen. Although the belly was enormously distended and tympanitic, there was no other sign of illness about him, and there was an entire absence of any one condition on which tympanites usually depends. After a few days' observation, and having carefully weighed all the facts of the case, the surgeon came to the conclusion that the man purposely induced the distention by swallowing air. Loudly enough for the prisoner to hear him, he accordingly remarked to the warder, "When I come to-morrow I shall bring an instrument to tap him." On the morrow the tympanites had

disappeared. (The same method of imposture is recorded by Gavin [" Feigned and Factitious Diseases," p. 299], who writes: " This affection, tympanites, has been so successfully feigned as to deceive a board of French medical officers; but this individual possessed the extraordinary power of greatly distending his abdomen by swallowing air. He, however, obtained an unqualified exemption from military service by presenting himself in this state, with clothes made for the occasion.")

More common are the cases where patients assure you that they are losing blood in large quantities from the bowel. The causes of hemorrhage from the bowel are well known, although an exact diagnosis may be sometimes difficult because of their very number and variety. The malingerer, however, does not know that profuse hemorrhage—and it is of profuse hemorrhage of which he invariably complains—gives rise to well-defined symptoms due to loss of blood. Who ever saw a patient losing blood, either in alarming quantities or in small amounts spread over a long time, with a florid lip, a tranquil pulse, a cool skin? Should not the presence of every indication of health warn us that we have to deal with something altogether unusual? Should we be doing rightly if we paid little or no attention to the general condition of the patient, and endeavored to estimate his case by simply hearing the story he told us, without examining the blood which he showed? By neglect of such simple precautions an erroneous diagnosis was made of a case where pints of blood, not the man's own, were presented as having been passed per rectum; and the same thing happened in another case where a man showed, from the same supposed source, prodigious quantities of " blood and corruption." Both were cases of imposition—subsequently known and proved—after railway accidents; and yet in both of them the fraud was successful. Surely when conditions such as these occur alone, when there is neither discoverable cause, nor the usual, inevitable result, one ought to be able to say of them at once, " Impossible, untrue!"

In the same category it is not amiss to refer to dilatation of pupil induced by the use of atropine, a point of some importance, because it has been shown in a previous chapter that a wide sluggish pupil is a valuable sign of loss of nerve tone. " The access to atropine or belladonna," writes Mr. Hutchinson, " on the part of the public is now so easy that we cannot

be surprised that we encounter mydriasis as the result of an accidental and perhaps unknown use of this agent, or of its use with intention to deceive. It is the first question which will occur to a surgeon on seeing a dilated pupil, 'Has atropine been used?' and he must be on his guard in cases of hasty denial. . . . Not infrequently the ophthalmic surgeon has to encounter cases of intentional deception. These occur usually in young women of emotional tendencies. . . . A highly-cultivated young lady consulted me for 'pemphigus.' She had blebs all over the left half of her body. But these blebs were, some of them, not round but oblong, in a style which no skin disease ever assumes, and very obviously the result of the application of a brush. She was liable also, I was told, to attacks of dilatation of the pupils and loss of ability to read. These attacks usually lasted a week. This case is only an example of what has frequently come under my notice. Although it is possible to use atropine in such a weak solution that the ciliary muscle is not affected, yet in most of these cases a more complete effect is obtained, and the loss of power to read is produced in addition to mydriasis. If the latter be present alone, and if it persist for long, the suspicion of deception may be put aside." ("On the Symptom-significance of Different States of the Pupil," "Brain," Vol. I., p. 462.) In all cases where the use of atropine is suspected, it is essential to examine the patient frequently, and carefully look for some concomitant and confirmatory symptom of nerve disturbance. The pupils, moreover, it need hardly be said, must be examined both in light and shade; and it should be borne in mind that, where there is inequality of the two pupils, the dilated pupil need not necessarily be the one affected. The pupil which is the smaller of the two may, for example, be unable to dilate, and be the one really at fault, because of sympathetic paralysis—a condition of things by no means unknown after organic injury to the lower cervical spine. The question might here arise whether eserine had been used, but I am not aware that eserine can induce the other signs of sympathetic paralysis—shrinkage of the globe, and contraction of the palpebral fissure.

Let it not, moreover, be forgotten that any kind of old injury, deformity, or want of perfect symmetry may provide the malingerer with the opportunity for the practice of im-

posture. Hydroceles, varioceles, and herniæ; fatty tumors, sloughing gummata, and sebaceous cysts; distended bursæ, and anchylosed joints from long-past disease, are some of the conditions, which, in my own experience, have been attempted to be palmed off as the result of railway shock. No man who knows his business can be taken in by such things as these. Great care, however, must be always exercised in the examination and estimation of abnormal conditions which may be presented, that no injustice may be done a man in coming to a hasty conclusion that he is malingering.

It is singular, for example, how ignorant some persons seem to be of the existence of deformities, or states of body, which must have been endured for a long time.

Case XXVI.—*Case of Old Lateral Curvature of the Spine—Condition Unknown to the Patient.*—A man, seventy years of age, came to St. Mary's Hospital, complaining of pain over the right side of the thorax. When he had been stripped, it was found that he had lateral curvature of the spine to an extreme degree. He said that this condition was of quite recent date, and that he had only noticed it since he felt the pain. Judged by itself alone his story was enough to cause alarm; but, both from the ossification of his costal cartilages, and from the fact that there had been no alteration in his stature, it was clear that the spinal curvature was of old standing, in all probability nearly as old as the man himself. Had it been an acute change at this time of life, and had the pain which brought him to the hospital been due to the curvature, or been a symptom of some serious malady which lay behind it, a simple liniment and a tonic would hardly have restored him in a short time to his usual state of health.

So also the absence of perfect symmetry between the two halves of the body, some trifling difference in the facial lines, or slight excess in size of one limb over the other, and of one half of the spinal muscles over the other half, may be regarded, when taken by themselves, as evidence of very grave disease.

Case XXVII.—*Paralysis from Pressure on Musculo-spiral Nerve—Accompanying Facial Asymmetry.*—A laborer, aged forty-two, came to the hospital on June 12th, saying

that on waking from his usual nap after dinner the previous afternoon, he found his right arm and hand "numb," his fingers and thumb flexed, and his wrist dropped. This paralysis of the extensor muscles was partial only, and was accompanied by some tenderness above the elbow on the inner side of the arm, and by a small anæsthetic area over the ball of the thumb. As usual, recovery was slow, and, although he was then able to work, he had not regained full use of his wrist and hand when he was seen six weeks afterward. Interesting though this part of the case may be, the special point about it was the fact that the left side of the man's face was almost entirely wanting in facial lines, while their presence on the right side gave him the appearance of having left facial paralysis. To the palsy of the arm there thus appeared to be added paralysis of one side of the face, and the combination might have suggested grave disease, had not a careful inquiry into every circumstance of the case led to the diagnosis that this asymmetry was peculiar to the individual. And this opinion was subsequently confirmed by the patient himself. Yet how easily, under the besetting temptations of railway injury, might a hastily-expressed conclusion as to the pathological origin of such a state have given an unscrupulous patient the opportunities of using his natural peculiarity for purposes of deception and fraud. We meet with such conditions every day, and it is of supreme importance to recognize and rightly estimate them, not only that we may allay the anxiety of the patient who honestly believes his old complaint is new, but also that we may nip the means of deception in their very bud, and not ourselves unwittingly befriend the imposture.

I shall not attempt to enter in any detail into the feignings of paralysis and kindred nerve diseases. The same principles must guide us, and we shall find them very seldom fail. The artifice may be clever and well devised; it may be long sustained and free from variation; but it is very difficult, and therefore rare, for the malingerer to simulate a real disease with accuracy. He exaggerates; that which he could not do he does; he will not do that which he could do if his state were real; and you find that his symptoms are such as you have never seen or known resulting from any affection of the

brain, the spinal cord, or the nervous system generally. Subjective symptoms largely predominate, and you observe that such objective symptoms as he has are mostly those over which he can exercise his will. He cannot make his eyelid droop; his tongue does not always deviate, nor is the angle of his mouth always drawn; he knows not how to paralyze his bladder; there are no bed-sores; he does not waste; his palsied limb resists examination; his fits occur at convenient moments when he cannot harm himself, or when he can be under the observation of those who do not know their import or their signs; in his coma he is not unconscious; and added to all he has the aspect of health, nor is any vital function deranged. ("In peripheral paralysis of the facial the expression of the face is very striking, for, owing to the loss of muscular tension on one side, it falls, while the opposite side is drawn up. This distortion is much increased in smiling or talking, or whenever the influence of the will is exerted on the muscles" [Wilks, op. cit., p. 439]. But in laughing or talking the impostor moves, he cannot help moving, the paralyzed side, and the asymmetry becomes less instead of more obvious. I have a case in mind.)

The so-called functional, hysterical, and neuromimetic disorders have many symptoms which often look like imposture, but I believe that the sufferers who present them are prone to deceive themselves more than other people. That the manifestations of hysteria are not necessarily feigned, or due to expectant attention, is indeed shown by the fact that they may be found even in young children, who have what may be called the requisite hysterical neurosis. Some remarkable cases of "hysterical analgesia in children" recorded by Dr. Barlow ("British Medical Journal," Vol. II., p. 892, 1881) show conclusively that a symptom of hysteria, which in the adult may lead to the suspicion of imposture, may be seen in children so young that the very idea of feigning is out of the question. As I have already pointed out, the one common characteristic of all these cases lies in a strange perversion and abeyance of volitional power or will, whereby each action, word, and thought seem to run riot, as it were, for want of due control. Largely unreal and independent of structural change, the symptoms admit of easy exaggeration and representation whenever the uncontrolled whim of the moment al-

lows; but having grown, step by step, out of slighter conditions which there was neither the wish nor the determination to subdue, they seem in their very nature to exclude deliberate imposture. Practically, too, the kind of treatment these disorders require is very different from that which suffices to cure ailments altogether feigned. Be the condition, however, what it may, to the patients themselves it is very real: the pain, the stiffness, the palsy, are as great to them as they are described, or as full of evil consequences as it is imagined and believed. The symptoms may be of little moment in themselves, but it is wrong to look upon them as altogether feigned.

The cases already given in illustration of some of the points and principles, which it behooves us to bear in mind, have been designedly drawn from ordinary hospital work; and they are of value in showing that no special practice is required to teach important lessons bearing upon the subject, and that these can be learned from cases which are met with every day.

As I have already said in speaking of the after-history of nervous shock, so now in turning to the more special topic of malingering after railway accidents, it must be acknowledged that ordinary hospital patients provide little opportunity for gaining familiarity with the kind of malingering with which we have now to deal. This, however, has to be noted, that, whatever may be said of every other form of malingering, there is no obscurity or doubt in the case of railway injuries as to the motive which may induce a man to exaggerate or to assume symptoms of disease. It may be summed up in the one word "compensation," to which the law of the land entitles him, whether for damage to his person or loss in his business consequent on the negligence of the public company which had engaged to carry him. Has his injury been great; has he lost a limb, or been otherwise maimed; or has his life been then, or in the future, imperilled; it is almost needless to remark that, while no money can adequately compensate him, the amount to be paid him must of necessity be large. When, however, the injury is trivial and passing, when there is neither structural damage nor prospect of lasting enfeeblement of body or mind, it is evident that the amount of money sufficient to compensate him ought to be very small. And herein, in the endeavor to gain large compensation for small injuries, the malingerer finds reason and excuse for practising decep-

tion in order to magnify his claim. The motive is one requiring great moral courage to resist. Many a man, whose character hitherto has known no stain, has yielded to the temptation, and has thereby lowered himself in general esteem. It is not the language of sentiment but of sober fact, when it is said that whole households are sometimes made miserable by the devices to which it is needful to resort, in order to obtain the desired end. Hopes are conceived of future gain, thoughts are centred on the one aim in view, and there is but a sorry consolation when the day of reckoning has come. So powerful indeed is the motive that you find persons taking to their beds, abstaining from food, shutting themselves up, neglecting their business, and making themselves weak in body and wretched in mind. While, however, this has to be written of those who wilfully malinger, it would be doing many an injustice if we did not recognize that prospective compensation may exert a retarding influence on the process of recovery quite apart from any deliberate imposture. Entitled as he is to compensation, it is only natural and right for a man to feel anxiety, both in his own interests and in the interests of his family, that compensation should be adequate and fair, and a nervous, yet really honest, dread may be engendered lest some mistake be made in the settlement of a rightful claim. The injurious influence of any such nervousness and suspense is sufficiently obvious, and it may sometimes be a matter of no small difficulty to determine whether the protraction and aggravation of a man's illness are really due to one cause or the other—to wilful imposture taking the form of not choosing to recover, or to the unconscious weight round his neck which arises from apprehension as to compensation. I have never known any difficulty, however, in making the honest sufferer understand how and why the settlement of his claim for compensation will, more readily than drugs or change of air, promote his recovery and work only for his good. Some may think that there need not be much regard for the feelings of an impostor.

Curiously alike are the means of deception adopted in different cases, and it is extraordinary how persons in the humbler walks of life possess a knowledge of the kinds of injury, which are popularly deemed inevitable in a collision. Provincial journals are to some extent responsible for this, for in

them are often to be found in considerable detail the history and symptoms of those who, by litigation or otherwise, have received compensation from railway or tramway companies. And if a man has in this way learned that large compensation was awarded for injuries apparently like his own, it is a great temptation to him to adopt courses which seem to him potential of future gain. A publican well up in years made an exorbitant claim for trifling injuries. His enlarged prostate gave rise to the usual symptoms, but when it was pointed out to him that this was the real cause of his urinary trouble, he replied, "No, it is my spinal cord to which all my symptoms are due." "Drag your leg, you fool; don't you see the doctor coming?" called out by a workman to his fellow, who had been in an accident, and heard by the doctor as he was then crossing the yard to see him, was but the audible expression of many a like lesson, which may be learned with ease in the solitude of a sick-room. And as the views of the nature of railway injuries have changed, so also has there been a notable change in the methods of imposture. Ten years ago the malingerer could not walk, or he dragged his leg because of some obscure injury to the spine; nowadays he presents an admirable picture of nerve prostration, for his nervous system has had a severe shock, the consequences of which are readily induced by abstinence from food. This is unquestionably a far better way of malingering than the endeavor to simulate some spinal disease, for the fraud in that case can be soon found out; but in the case of wilful starvation it is only a question of time when your waistcoat will hang flabbily about you, and you can measure at any automatic, and thoroughly trustworthy, machine the number of stones you have lost in weight. It caused no surprise at all that a man, who had been going about on crutches for months, should have led off the dance at a ball which he gave to his rejoicing friends at the close of litigation; but I have heard expressions of genuine amazement at the speed with which the human form divine has sometimes put on flesh.

And yet it is unusual, in my experience, to meet with cases where it would be possible to say with certainty that no injury has been received at all. The pain of some trifling bruise or strain is exaggerated and unduly prolonged, and thence are developed other conditions and complaints, in whose very

obscurity lie the ready means of untruthfulness and deception. The still wide-spread, yet erroneous, impression, that the effects of a railway collision are likely to be remote, does much to foster a sense of uncertainty and alarm, and to give the malingerer scope for the course which he intends to pursue. And so it comes to pass that it is after the most trivial accidents, or in cases where no definite injury has been sustained upon which to base a claim, that we hear most often of the obscure, subjective, and intangible symptoms and complaints, which are supposed to indicate some serious damage to the nervous system, and to forbid all prospect of future recovery. Is it not a strange anomaly, something altogether extraordinary, that it is only the slightest injuries which are followed by these purely subjective symptoms, whose very obscurity gives rise to alarm? Is not some light, however, thrown upon them by the facts of accumulated experience, that these symptoms vanish and the complaints are no more heard when the motive for their existence is at an end? Have we not strong grounds for doubting their genuineness and reality? Are we right in ignoring the absence of early symptoms and signs of injury or shock, and in assuming that a condition is alarming, or a prognosis grave, simply from assurances of the patients themselves? And yet this is what is seen far too often in dealing with cases of alleged injury after railway accidents. Little regard is paid to the early condition and to the actual state of the patient, and undue attention is given to ceaseless complaints of hidden symptoms, whose real existence you should be all the more cautious in acknowledging, being as they are without objective signs, and traceable to no injury met with in the beginning. Time runs on, the complaints become louder and more continuous; and forensic eloquence, it may be, is left to tell a harrowing tale of the frightful collision, and of a nervous system shattered and beyond repair.

I trust that I am not myself lapsing into the "region of nisi prius." These are facts, however, and it would be well if they were more widely known. That cases of severe and unquestionable injury should usually go on to recovery, or to such restoration as the nature of the injury will allow; and, on the other hand, that cases of slight injury, from which recovery without complication or sequelæ is, in other circumstances, the rule, should after railway collision be followed by

innumerable and protracted subjective symptoms on which not a finger can be laid, are facts to arrest attention and to call for explanation. And the simplest explanation is the best. In the one set of cases there is an obvious basis of compensation for the definite injuries received; while in the other there is little or none, and there arise exaggeration and unreality, and subjective symptoms to make the specious foundation of a claim. But enough, perhaps, directly and indirectly, as to the motive for malingering. It is notorious, and it has an all-powerful influence over the course and symptoms of railway injuries.

Let us now learn from definite examples something of the ways of malingerers.

Case XXVIII.—*Slight Sprain and Nervous Shock—Protracted Symptoms from Wilful Starvation.*—A travelling agent, aged fifty-eight, received, in a trifling collision, a blow over the right iliac crest. He complained to a fellow-passenger at the time, so he said, of being hurt, and of feeling rather faint. There was never any mark of bruising, and his medical attendant—a hospital surgeon well able to judge—thought his injury altogether trivial. The patient, however, abstained from his work; nor did he resume it until eleven months had passed away. During this time he complained of pain about the right hip, which compelled him to use a stick and made him walk lame; of pain in the head; of inability to sleep; of poor appetite and nausea; of constipation; of such general weakness as to prevent him from walking a mile, and that only now and then; of impaired vision, so that he could only read the largest type; of loss of memory; and of incapacity to apply his mind to anything, so that neither physically nor mentally did he feel himself fit for any occupation. He frequently stayed in bed for the whole day, and rarely got up before twelve; for days together he never went out-of-doors, and he took the very smallest quantity of food. Thus he gradually acquired a worn and anxious aspect, and looked pale, thin, and ill. No known means of examination were able to discover any sign whatever of injury or disease; and although he twice undertook journeys of some two hundred miles to be seen by a well-known oculist, could I ever, with the ophthalmoscope, find a trace of disease in his eyes, or any

cause for his loss of vision. No remedies adopted seemed to have the slightest effect upon him. Liniments did not soothe his pain, soporifics did not make him sleep, and tonics improved neither his appetite nor his strength. On only one occasion did he give a clue to the absence of perfect genuineness and reality in his case. To the surgeon who had several times examined him by request of the railway company, the patient one day remarked as he left the house, "You've got a cobweb on your hat, perhaps you'd like to brush it off." He was known to be at this time, and he had been formerly, in pecuniary difficulties. He made a very large claim. This was ultimately settled, and he forthwith went into the country for change of air. He returned home in a fortnight looking and saying that he was in every respect perfectly well. He resumed his work at once, and continued it for many years after the accident. Could recovery in this case have taken place in so short a time had the symptoms and complaints not been purposely induced, maintained, or fabricated? Is it not as well-nigh certain as can be that had not the prospect of compensation held out the temptation to this man to make the very worst of his injury, with the hope of pecuniary profit to himself, he would have been laid up for not more than two or three days? And yet he was an invalid for eleven months —a wretched picture, indeed, of induced malaise; but a malingerer nevertheless, purposely maintaining his condition in order to increase his claim.

Case XXIX.—*Physical Injuries—Nervous Shock—Early Recovery.*—Two cases out of the same accident, those of a father and son, may be compared. The father, a man in a small way of business, aged fifty-eight, was seen in bed at an hotel in a provincial town the morning after a bad collision. He was unable to give any account of the accident, having been stunned by a blow which had closed both his eyes. He had also a broken rib, and was much bruised elsewhere. He had had about two hours' sleep in the night, had rallied, and felt better. A week later he was still mending, and although he was pulled down by rather severe epistaxis, he was able in twenty-four days to be moved home. There he continued to go on well. In six months his claim was arranged without trouble for a reasonable sum, and when I saw him three months afterward he looked and said he was perfectly well.

Case XXX.—*Slight Injuries—Prolonged Complaints—No Evidence of Ill-health.*—The son, a strong and powerful man, aged twenty-four, a messenger by occupation, was not stunned, and was able to help his father to the hotel. When seen on the following day he said he had had a good night, but that he felt rather shaken. He had a slight bruise on the right knee, and a simple fracture of the third metacarpal bone of the left hand. A week later, to my astonishment, I found him still in bed, but neither in aspect, temperature, nor pulse was there anything abnormal, and he had been able to eat and enjoy, from the very morning after the accident, three meat meals a day. He was ordered up, and he would have been sent home immediately had not the illness of his father obliged him to stay. When he got home he at once, by the aid of a litigious lawyer, took steps to make an exorbitant claim against the railway company. Two months after his return home he had not yet resumed his work. The reasons assigned for this were that he had giddiness and pain in the head, that his memory was bad and his sleep disturbed by dreams of the accident, that he was very weak and incapable of work, and that he could not trust himself to apply himself to anything. His knee and hand were still in bandages, the arm being carried in a sling. I failed to discover any sign whatever of ill-health about him. Thus he continued to complain and to live in idleness until ten months had flown, when a jury awarded him a sum in reasonable compensation, or about one-fourth of that which he had demanded. He was then to every appearance and test in perfect health, though still complaining as before.

Case XXXI.—*Slight Shock—Prolonged Complaints—Absence of all Symptoms.*—A man, aged forty-two, strong and healthy, was in two slight collisions. In the first there was no evidence or history of his having received any blow or injury. He stated, however, that the day after the accident he felt weak, ached all over, and had pains in the loins and legs as if he had a cold. No amendment took place, nor had he indeed been free from suffering up to the time when I saw him eight months afterward. He then complained of weakness and fatigue, of bad sleep and loss of memory, and of such great nervousness that the whistle of an engine or the sound of a train threw him into a state of excitement. His manner

was whining, and he made several attempts to cry. His medical attendant had never found any evidence of illness beyond the statements made to him by the man himself. Neither in his general aspect, nor in the action of any one of his organs, could any sign of ill-health be discovered. He abstained from work for fifteen months, and at once resumed it on the settlement of his claim, then grown in size through length of alleged suffering and loss. Two years went by, and he was fortunate enough to be in a second collision in which he received a trifling bruise on one leg. He at once abstained from work, placed himself under medical care, made precisely the same complaints as before, and presented as little evidence of ill-health. Again there were months of idleness, and again on the settlement of claim immediate recovery, and return to work.

Further examples of this particular kind of malingering are hardly necessary, although many might have been given, which, with insignificant variations, have followed the same course. They are often styled cases of "shock to the nervous system." Their chief characteristic is the obscurity, the intangibility, and entire subjectivity of all the symptoms and complaints which disappear at a particular moment. They are not rarely accompanied by some manifest disturbance of health, which is induced by the mode of life to which the individual restricts himself. Can want of proper occupation and exercise act otherwise than harmfully even to a healthy man? Sleep becomes unsound, the bowels are sluggish, appetite fails, the glow of healthy energy and vitality is lost, and there is no longer the picture of perfect health. Be the bodily derangement thereby great or be it infinitesimally small, health and vigor are restored, and work is resumed, as soon as it is no longer incumbent on the man to appear ill and to remain idle, and when the requisite effort to return to a natural mode of life is once more allowed. The man has nursed himself into a state of illness, and has thereby generated a condition of spurious nervous shock, and if he only has the prudence to complain of his back, his case becomes a grave one of so-called concussion of the spine.

Examples of this induced illness are far from uncommon, and the very fact that the patient seems really ill places an additional difficulty in the way of an accurate diagnosis of the

cause. Apart from the necessity of learning what was the precise nature of the accident, and how the man was hurt, it is very essential to know how he passes his time, and what are his habits and occupations day by day. It is of paramount importance to separate objective signs from subjective symptoms. The absence of signs, and the presence of subjective symptoms alone, may fairly warrant a suspicion, which ought to entail the most careful inquiry into all the circumstances of the case. Why is that man in bed? why does he stay for weeks in-doors? why is he taking hardly any food? why is he pale and thin? why does he sweat?—questions such as these the surgeon should ask himself, and he should not rest satisfied with a tacit belief in what he hears or sees.

In other cases there may be a combination of obscure subjective symptoms and of precise objective signs which throw mutual light upon each other, or which perchance may tend to make a diagnosis still more difficult.

Case XXXII.—*No Injury—Prolonged Complaints—Immediate Recovery on Settlement.*—A traveller by occupation, aged fifty-three, out of employ, took to his bed and called in a doctor three days after a most trifling bump against the stop-blocks in a station. He made the usual complaints of pain, of shock to his nervous system, dimness of vision, loss of memory, and the like, but there was never any sign whatever of ill-health or functional derangement beyond what might be fairly attributed to some atheroma of the aorta. The extravagance of his language and his exaggerated estimate of all his complaints were in themselves enough to raise suspicion as to their reality. Objectively he complained of loss of power in the right arm with stiffness of the right elbow, and of a putty-like sensation of the left leg below the knee and stiffness of that joint. In all ordinary movements, such as undressing or helping himself out of bed, he used the right arm quite as much as the left. It presented no difference from its fellow, though when speaking to him about it he always held it against his side. He resisted with great force when you attempted to bend it, and he called out loudly, as if from pain, when you touched the arm, however lightly, about the elbow-joint. His left leg showed no physical signs of injury or disease about the knee. Held usually rigid and stiff, he resisted

any attempts at passive flexion. Flexion to the slightest degree, he said, caused him great agony, although his face showed no sign of suffering. On another occasion he complained of excessive hyperæsthesia of the left knee, however gently you touched it with the finger, although he pulled up and put down his trousers over it with perfect composure. He complained of great agony in his bladder, although he only passed water at natural intervals and in proper quantity, and he could hold it for six, eight, or even twelve hours. He stayed in bed about ten weeks, and took, as he admitted, hardly any food. Toward the close of the twelve months, during which this state of things went on, he had become somewhat weak and thin. Quite early he had made an exorbitant claim, and the natural result was litigation. While waiting for his action to come on the man was to be seen walking about Westminster Hall with the lame stiff leg, and the flexed arm held rigid to his side. His action over, he there and then resumed a natural gait, all trace of lameness having passed away. Were the subjective symptoms less unreal than those which so quickly vanished ?

Case XXXIII.—*Purposive Vomiting—Immediate Recovery on Settlement.*—Now let us take another case which offers, perhaps, greater difficulties in diagnosis. Omitting details of the usual subjective ailments, the objective signs of illness were frequent vomiting, and such apparent weakness of the legs that walking was only slow and labored. The surgeon who saw the man on behalf of the railway company, and who gave me the history of this case, felt sure from all he saw that the symptoms were far from genuine, and among them that the vomiting itself was a deliberate volitional act. It was, to say the least, a suspicious feature in the case that the patient had been seen, when he thought he was out of sight, to start off at a natural pace, swinging the stick on which he had been compelled to lean only a moment before. Knowing all this, the surgeon felt it his duty to tell the private medical attendant what he thought about the case, and he resolved to do so on the next occasion when they were to meet at the doctor's house to see the patient. Having told his opinion, the doctor pointed out the utter impossibility, in his belief, of so grave a symptom being voluntary, and took him into his own yard to show how the man had vomited since

he came to his house not long before. The surgeon's opinion, nevertheless, remained unchanged, and the result of the case justified and confirmed it. Infirm of body and mind, incapable of work, vomiting up to the day of his action for damages, the man immediately recovered when litigation was over.

In the case of a horse-dealer who rapidly wasted and became extremely ill, and in whom the most prominent symptom was sweating, the man subsequently acknowledged, when his speedy recovery after compensation excited his doctor's surprise, that he had deliberately sweated himself by violent exercise in thick clothing in order to reduce his weight and size.

To those who have never seen such cases it may appear almost incredible that symptoms like these can be volitional and unreal. (Some remarkable instances of factitious vomiting are recorded by Gavin, op. cit., p. 256 et seq.) Take, however, into consideration every circumstance and feature of the case; learn what has been the original injury; recognize how singular it is that a symptom, alarming in itself, should be by itself independent, and without ill result; remember how powerful is the motive for deception; inquire what steps the patient is taking to gain the desired end, and there are the means, if you will only use them, of arriving at a right diagnosis.

The character of the original accident and injury is far too often forgotten in the later examination of these cases, and a trifling bump is magnified into a serious collision.

Case XXXIV.—*Slight Injury—Gross Exaggeration—Rapid Recovery after Settlement.*—A man received an altogether trivial blow on his side, from the manner in which he happened to be sitting, when the train attached a carriage at a station, and the so-called accident ultimately became a severe collision, in which the train had been backed into a carriage at the great speed acquired in a run of half a mile, with a crash like thunder. This was the story upon which those were asked to form an opinion who were called in to see him, when, after several months, he had nursed himself into a condition of much weakness, nervousness, and malaise, and when his very obvious illness seemed almost to demand a serious

accident as its cause. It is very natural that there should be some distrust in the statements of railway servants as to the precise violence of a collision or other accident. The absolute and unvarnished truth as to the real severity of the accident was known, at any rate, in this case, and was somewhat different from the alarming catastrophe to which testimony was borne in a court of law, where a jury is supposed to get at the actual facts. A large sum of money was awarded to this man in compensation, and he instantly invested it in a business which he proceeded forthwith to carry on himself, with all the appearances of perfect health, and without any further need for medical treatment.

Case XXXV.—*Simulation of Spinal Injury and False Statement as to Accident.*—A highly respectable frequenter of the turf took to his bed after a very trifling collision. He was unable to give any account of the accident, having been knocked insensible, and been carried in an unconscious state to the waiting-room of a station, distant a quarter of a mile. He had, however, been able to make a long journey home two days after the accident, that is to say, when the races were over; and he at once took to his bed. I saw him on the eighth day. When asked what he complained of, he answered with ready assurance, "Shock to the nervous system, and injury to my spine." He could give no other account than this of his complaints, except that he was wholly unable to get out of bed. Examination, which failed to discover the slightest trace of injury or constitutional disturbance, accidentally revealed that this gentleman had a chancre; and the discovery afforded the excuse for promptly ordering him to get up and walk. His doctor had regarded it as a case of very serious spinal injury. The claim was forthwith settled for a small sum.

Case XXXVI.—*Alleged Spinal Injury—Gross Imposture.*—This same man subsequently appeared as a witness on behalf of a friend, who had brought an action for damages for a like alleged injury in the same accident. He was a most valuable witness, for he swore that he and another man had carried their friend, then perfectly unconscious, from the scene of the accident to the waiting-room at the station. The friend, an even more outrageous impostor, had had a slight bruise on one hip. He also finished his mission at the races, came home, and at once took to his bed, complaining of his spine. "The

pain in his back," so ran my report some weeks after the accident, "is so bad that a longer stay than half an hour out of bed is, he says, almost more than he can bear. His pulse is perfectly tranquil, his temperature normal, his aspect not that of ill-health or urgent suffering, and the appetite and bodily functions are as good as can be expected in any one who has so long been without appetite and in-doors. It is my conviction that he is grossly exaggerating his symptoms and complaints. There is no evidence whatever of injury to his nerve-centres, either cerebral or spinal; nor is there any ground for believing that there is any real tenderness of his spine, for wherever I touched him, whether on the spine itself, on the muscles near it, or on the ribs far away from it, there was the same unreal hypersensitiveness and manifestation of suffering. That he has some pain here and there is quite probable; but there is no disease such as to call for his stay in bed or in the house for another day." It need hardly be said that litigation ended this case, which was a highly profitable one for the lawyers.

Three years afterward it was learned from this man himself—perhaps in the circumstances the least trustworthy source of information—that his case from beginning to end was a fraud, that he was never hurt at all, and that no amount of money would induce him to go through such a course of illness and confinement again, or to endure such suffering as he had at the hands of those who deemed it necessary to run pins into his legs and to apply the "electric test" to measure his assumed insensibility. I venture to say that no such "tests" were ever needed, and that their tendency was only to confuse and obscure what ought to have been sufficiently obvious to every one who saw the patient. How fallacious they are, and in this case were, it is superfluous to point out, and yet they were solemnly given in evidence in court as conclusive signs of the serious nature of the man's disease.

Then, again, there is a class of cases where the patient may simulate the mimicries of disease. There are none in which it is more imperative to know something of the patient's history, of his previous health, his position in life, his condition immediately or soon after the accident, the nature and extent of the accident itself, and the whole aspect of the case from beginning to end.

Case XXXVII.—*Slight Injury—Prolonged Simulation and Rapid Recovery after Settlement.*—T. J., aged forty-three, was in a slight accident, in which he had a small bruise on one cheek and also at the back of the head. He was seen shortly after the accident, but there was no sign either of injury, beyond the bruises named, or of constitutional disturbance. In about ten days he was "taken worse," but in no very definite way. He gave notice of a claim, and then began to complain indefinitely of pain in the back, of pain in the legs, and oppression in the head. There was still, however, no evidence of illness or constitutional disturbance. He continued to get worse, and two months after the accident took to bed. He had not been in bed many days when he had a "bilious attack," with constipation and vomiting. A month elapsed, and he then was seized, so he said, with a "convulsive attack" in which his legs were drawn up, and he was very violent. From that time forward he professed to be troubled with "contractions of the limbs and severe pain in the legs, aggravated by attempting to sit up." He also complained of queer sensations all over, numbness in his tongue, for example, creepings in his legs, tenderness of the palms of the hands. Pulse and temperature alike remained perfectly normal. Five months after the accident he was still in bed complaining of great pain in his back, of pain and tenderness in the legs, and of inability to stand if he got out of bed. He held his hands out somewhat in the position of tetany, but the contraction immediately disappeared when he ceased to direct attention to it. Although when he first got out of bed he allowed his legs to slip away and himself to fall, he only had to be engaged in conversation to show that his legs were amply strong enough to support his whole body. There were no objective signs whatever of paralysis, nor was any illness to be discovered about him, except such as might fairly be accounted for by his having been in bed for three months. Thus his muscles were somewhat flabby, his face was pale, and this tongue was furred. Temperature and pulse, however, were normal; his pupils were of healthy size; his mind was perfectly clear. So his state continued until the close of a year, when his claim was settled by compromise on the verge of litigation, it being held that he had received a very severe injury to his nervous system, that prospect of recovery was very small, and that it

was wholly impossible for him to appear and give evidence as plaintiff at the action. His evidence was indeed taken by commission, the man being quite unfit to leave his bed. He had made a very large claim—not the first in his life, for he had received compensation for alleged injuries some years before. Mark the sequel. In ten days he was out-of-doors, in a fortnight he went away for change of air, and in two months he resumed his usual work. He has continued at work since that time in the enjoyment of good health.

In instances such as this it is often difficult, and well-nigh impossible, to say whether the condition is one dependent on genuine neurotic disturbance or is altogether feigned. And the difficulty is largely due to the fact, that a disorder of this character may be more or less under the control of the patient himself, as it has been pointed out on a previous page. It is therefore of the greatest importance to search for some symptom, which may rightly be placed in the category of hysterical or emotional disorders. Every objective sign that you discover may be under the patient's own control, may be a physical condition altogether assumed, and the clue to the whole case may be entirely wanting until some symptom be found, which is outside, and beyond his voluntary control, or is even unknown to him. Analgesia or anæsthesia, for example, may form the only indication of the real character of the disease. Dr. J. Putnam has admirably dealt with this aspect of the subject in a paper on "Recent investigations into the pathology of so-called concussion of the spine, with cases illustrating the importance of seeking for evidence of typical hysteria in the chronic as well as in the acute stages of the disease" ("Boston Med. and Surg. Journal," Vol. CIX., Sept. 6th, 1883). After recording two cases of hemianæsthesia in men, he says that this is a symptom which shows that the nervous system has, in all probability, been subjected at some past time to a considerable perturbing influence, and its presence or absence might prove a welcome aid to diagnosis. A symptom of this kind may throw light upon a case, but it does not necessarily exclude a considerable degree of wilful exaggeration or even downright fraud in the other symptoms and signs. A deliberate impostor, for example, lost all tactile sensation over the mucous surface of his nares, a symptom which

it would surely be impossible to feign, and which was a clear evidence that some effect had been wrought, somehow and somewhere, upon the nervous system. Regions of anæsthesia, moreover, which follow no recognized anatomical distribution of nerves, say of one leg up to a precise limit at the knee or half-way up the thigh, are occasionally present, and it is obviously very desirable that no symptom of the kind should be overlooked in the examination of those cases where absence of the ordinary indications of illness and disease may suggest malingering. Marvellous and deeply interesting are such manifestations of the close interdependence of mental and bodily states, and, freed from the incubus of compensation and the temptation to malinger, it may be said of the nervous consequences of railway accidents, that they are not unworthy of the study of the ablest and most philosophical men in the profession.

We have nothing to do here with the pathology of morals, nor need we gauge the different degrees of moral obliquity in undoubted feigning and assumption of disease, and in wilful exaggeration of real conditions as a means to compass some aim in view. Were all cases of simple exaggeration to be included under the same head as cases of fictitious and feigned disease, the material would from very bulk become unmanageable. If, as it has been said, the motive be so strong and so prevailing, it is natural and only human that exaggeration should be met with in a large proportion of the persons injured in railway accidents. But, on the other hand, it must be remembered that exaggeration may not be, nay, very often is not, altogether wilful or assumed. Exaggeration is the very essence of many of those emotional or hysterical disorders, which are so common in both sexes after the shock of collisions. Here it may be an idiosyncrasy of the individual; there it may be the outcome of mental disturbance from the fright and alarm amid which the injury was received. It is only by a consideration of every feature and aspect of the case—clinical, pathological, social, and moral—that you can rightly estimate the kind of exaggeration or malingering with which you have to do.

CHAPTER VIII.

THE MEDICO-LEGAL ASPECT OF RAILWAY INJURIES.

It may not be altogether without advantage if a few concluding remarks are made upon those circumstances which are special in, and peculiar to, the class of cases considered in this book, and which are commonly absent from the ordinary accidents and diseases met with in every-day practice. Every case of railway injury is more or less the subject of medico-legal inquiry, for the extent of the injury itself and the loss which it entails have to be estimated, as far as possible, by a money value which is paid as compensation, and difficulties or disputes, which may arise in arriving at this estimate, may occasionally entail an appeal to a court and jury by process of litigation. All this may very materially modify the clinical aspect of individual cases and symptoms, and no right estimate of any case can be made if these circumstances are ignored.

At first sight, perhaps, it is not very clear why compensation should be an element of importance in the course and history of the spinal and other injuries received in railway collisions. Let us picture for a moment the change which would come over our hospital patients if a pecuniary value were to be placed upon every injury they sustained. The probability that many of them would see only the worst side of their ailments, that they would lay undue stress upon their pains, and would exaggerate the term of prospective disablement from work is at once obvious, were these to have a place in calculating the money-worth of the injury received. When a man has been prostrated by illness or injury, and convalescence has at length set in, we know that he must make some voluntary effort to regain his former activity both of body and mind. His habit of work and the daily routine of his life have both been interrupted, and it depends very largely upon his own efforts how soon and how successfully the thread shall be

taken up again. It is clearly to his interest to get well as soon as he can, and experience tells us that so keen is the desire for recovery and renewed activity, that many a man's restoration to perfect health is often retarded by his having begun work too soon. Suppose, however, that compensation is to be awarded for every ache and pain, and for every day that he is absent from his work, it is only natural that the keenness of his desire to resume his work should be very much diminished. If our hospital patients were to be compensated, we may be sure that the features of many a case would be completely changed, and that the whole clinical history of disease would wear a very different aspect from that which is usually seen. And changed for this reason, that compensation acts as a let and hindrance to the natural and very necessary effort, which each person must make for himself toward convalescence and resumption of work. It may do so quite unconsciously, for the knowledge that compensation will certainly be paid him for the injuries sustained in a railway accident tends from the first day of illness to give a tone to his feelings and to affect his own impressions of the sufferings which he may have to undergo. He is less likely to take a hopeful view of the future, is more prone to be despondent about the prospects of his recovery, and insomuch will his own personal efforts be weakened. It is well that this matter of compensation has no place in every-day hospital practice, and you will always do wisely, in endeavoring to form an estimate of the cases which involve medico-legal inquiry, to revert to your hospital experiences, and to recall the usual history of your hospital patients, both as to suffering and disablement, and the prospects of recovery.

It is not sought here to establish any doctrine so absurd as that settlement of claim can of itself be a curative agent, in the sense that it can hasten the setting of a fracture, remove the pain which is an inseparable concomitant of sprain of the vertebral muscles and ligaments, or restore the nervous tone which has been upset by the shock of a collision. The natural forces here, as elsewhere, tend to restoration of health; and recovery is, happily, as perfect after the injuries commonly received in collisions, as it is after any other kind of injury which the surgeon may be called upon to treat. There is this difference, however, and it is a great one, that when the

immediate effects of injury are passing away, and there is every sign that convalescence has set in, compensation holds out an inducement to the patient not to make the requisite effort to resume his work and his ordinary avocations, which are in themselves the best means of crowning the period of convalescence and of restoration to health. Had the ordinary injuries of hospital and every-day practice to contend with this element, convalescence would be very much hampered and prolonged, while if there was no question of compensation to enter into the contemplation of railway injuries, these in their turn would be recovered from with no less certainty and with much greater promptitude.

Human nature would not be what it is if compensation did not exercise this influence in delaying recovery, and it may do so even in the case of those who have been really hurt, and who are genuinely anxious to get well. Too much stress ought not, however, to be laid upon compensation itself, for very often it is the unsettlement of mind incidental to the arrangement of the claim, rather than the prospect of pecuniary gain, which is exerting an injurious influence. Happily the medical man is not often called upon to determine whether his patient is consciously making use of his injuries for the purpose of profit, or is the unconscious victim of this mental unsettlement, but he very frequently has to determine whether it is likely to be for his good that his claim should be arranged. Suppose, for example, that several months have elapsed since the accident, and that while there are no fresh indications of injury the symptoms nevertheless continue without amelioration, experience shows that settlement of claim is, in all probability, the one and only thing required to start the process of convalescence with reasonable hope of speedy recovery. Every now and then, however, there will come a case in which it is desirable that the claim should be settled soon after the accident. Money may be wanted to tide over the period of disablement and to insure the comforts necessary during a time of illness, or it may be obvious that there is great worry and anxiety as to the prospects of recovery and the future support of the family. In such circumstances it will not be the less beneficial to a man to have his claim settled, but additional care is necessary that in doing so he suffer no injustice. I think that a claim for severe injury ought never to be settled

at this time, whatever be the want of money, unless there is reasonable ground for honestly believing that no fresh symptoms indicative of a more serious injury than is then apparent are likely to become developed. Given such conditions, however, arrangement of claim is likely to be advantageous to the patient, provided that a fair basis for settlement be made by allowing for a certain period of probable future disablement. And this period has to be defined by the medical men after an impartial consideration of all the facts of the case. To lay down here in a book any hard and fast rule is manifestly impossible, as likewise it is well-nigh impossible to describe the indications for arrangement of claim as a remedial agent. At the bedside, however, there is not much difficulty in deciding whether arrangement of claim is advisable, and likely to be followed by good, or the reverse; nor is it I think very difficult to say beforehand whether the settlement of claim will be followed by immediate recovery, or will only act remedially by conducing to settlement of mind. It is, at any rate, quite erroneous to jump to the conclusion that a man is a swindler, simply because he recovered soon after getting a check from the railway company; and there need not be the smallest imputation upon a man in telling him that he had very much better arrange his claim, and that in all probability if he does so he will soon be well. I have many times been assured by compensated persons themselves, that the moment they got the thing settled they felt quite different beings, and, simply because the matter was off their minds, at once began to improve. And this, too, in cases where there has been severe and genuine disturbance of health. Here is a case in point.

Case XXXVIII.—*Slight Injury and Nervous Shock—Anxiety as to Claim and Delayed Convalescence.*—W. A., a stout elderly man, was in a rather severe collision. He was unable to continue his journey after the accident, but in two or three days he began to have pains in the back and to feel himself shaken, weak, and ill. He then returned home, a journey of four hours, and went to bed. There were no signs of injury other than those of slight sprain of the muscles of the back, with general nervousness and loss of tone. He steadily improved, and in two months it was thought that he was sufficiently well to arrange and settle his claim. He then, how-

ever, began to complain more; and four months after the accident he looked worse than hitherto, appeared ill and anxious, expressed himself unable to leave the house, and wholly unfit even to think of resuming his business. This went on for several months, and instead of any improvement taking place, he began to look more aged and worn, and not having been out of doors for a long time, lost appetite and weight, became prone to cry, and altogether presented an aspect so unhappy, that an opinion was given that he was permanently injured from "concussion of the spine," and would never be fit to do anything again. There were, however, no symptoms of serious illness or disease, and settlement of his claim was confidently anticipated as the one thing essential to restore him to health. Nine months passed without a shadow of improvement, and his claim was at length arranged. In a very short time he was perfectly well, looked in good health, and "ten years younger" than before his claim had been settled. Nor was this improvement transitory. He continued in perfect health, and five years after the accident was following his occupation with his usual vigor and in his former state of health.

A case, it may be suggested, devoid of all color, and wanting any tangible symptom at all, if we exclude the pain in the back which in former times was pretty sure to conjure up "concussion of the spine." But it is just these colorless cases which are often the most difficult of diagnosis, especially to those who have never seen anything like them before "I cannot make out," his doctor says, "why this patient does not get well. He seemed to mend at first, and I thought he was going to get over it soon, but now he appears to have no energy at all. Medicines don't do him any good. I urge him to make an effort to get about and try a little business, but he says he cannot; or if he does, that he breaks down again almost before he has begun." Complaints like this would not be heard quite so often, perhaps, were this clinical fact more fully recognized, that settlement of claim is frequently the most important agent to bring about recovery.

You need not seek to inquire too closely into the rationale of the change which may be thus induced. There is a release from the mental worry and annoyance inseparable from any long dispute, and a feeling that now, the whole trouble being

over, a fresh start is possible, and that persistent effort may once more be made to move about and resume work. Doubtless also there is some satisfaction in placing a good round check to your balance at the bank, which, in this age of progress and poverty, exerts a stimulus which no pharmacopœial preparation can supply. The attitude of the patient's own thoughts is wholly altered. Before compensation was effected he held out a goal to himself, and thought, and said: "When my claim is settled I will try and resume work; but I will wait and see how I am." When his claim has been arranged he argues thus: "Now I must begin my work again, and do the best I can." The effort, at all events, can at length be made, and with each succeeding hour of activity and occupation there grows up a healthier tone, and the rôle of the invalid is laid aside.

It is not only in cases like these, however, that settlement and repose of mind conduce to speedy recovery. A like result may be seen elsewhere; and it is a well-known fact, that the health of prisoners in jail has unquestionably improved after they have received their sentence, even though the sentence may have been far more severe than they had expected.

While, then, we cannot ignore the influence of this restorative agent, we must be more careful than ever that our knowledge of its efficacy be not improperly applied. An accurate history of the injury, and of the accident in which it was received; a careful observation of the patient's condition immediately after the accident, and of his progress in the days and weeks which followed; an impartial comparison of his case with others of a like kind which have been met with before—these things will guide to a right estimate of the facts when recovery seems to be unduly slow, and when examination reveals no signs of disease to account for the delay. And, although it does not fall within his province or business to deal with the matter in any way, it is yet necessary for the doctor sometimes to know what steps the patient is taking to obtain compensation, and how far this question may presumably be engaging his mind.

It must be remembered, however, that, although compensation has this influence upon the recovery of patients about whose *bona fides* there may be no suspicion, with others it may act as an irresistible temptation to wrong. Hence arise

some of those difficulties which surround the clinical inquirer, and which entail obvious duties and precautions on the medical man. He must endeavor to hold the balance as evenly as may be between the two sides which are more especially concerned in every medico-legal inquiry; and it behooves him, above all things, to take care that no affection of coincident origin, nor any precedent deformity or disease shall be allowed, through ignorance or carelessness on his part, to form an item in the claim which the patient may think fit to make for the injuries he has sustained.

You can never tell how readily a patient may adopt a suggestion which has been unwittingly put into his mind, or how soon an unguarded word or opinion may give a tone to the symptoms which they would not otherwise possess. Avoid, therefore, as far as possible all leading questions, because the use of them may suggest symptoms which had no previous existence. In a gross case of fraud which fell under my notice, a grave opinion was formed of the symptoms because a leading question prompted an answer which was wholly untrue. The man complained of giddiness; and as vertigo was known to be often the result of diplopia, the patient was hastily asked if he saw double. "Yes," was the reply; and led on by further leading questions, a very serious train of alleged symptoms was revealed. Not one of them was true.

The clever impostor who, some years ago, went the round of the hospitals, and simulated many nervous disorders with varying degrees of success, lacked in his marvellous exhibition of tetanus the usual rigidity of the abdominal muscles. A remark was made at his bedside, when he was in one of the worst of his seizures, that it was strange the tetanic spasm, so extreme elsewhere, should not also affect the muscles of the abdomen. The next day they were as hard as a board.

Not less important, also, is it to avoid the unnecessary use of leading methods of examination. I would not in the smallest degree detract from the value of instruments of precision, but their use is often quite unnecessary, the cases being singularly few and far between which demand the whole armamenta of the specialist, who with dynamometer, æsthesiometer, audiometer, lenses, and battery, finds out some trifling departure from the normal which may be made the unfair groundwork of a claim. ("Were a pathologist," writes Dr. Moxon [Croo-

nian Lectures, "Lancet," Vol. I., 1881, p. 568], "with a grave microscope to spy through all our brains as we sit here in states of satisfaction, he would certainly see a great deal in the way of tortuous capillary and dots of yellow pigment—a great deal that under the microscope would look very alarming.") Of what earthly use are observations by the dynamometer, for example, unless you know that the patient is telling you the truth? You discover, forsooth, that he squeezes with a force of fifty pounds with his right hand and of ten pounds with his left, and you forthwith create the scientific and incontrovertible basis of a lie. A little common sense is often of more use in diagnosis than all these instruments put together.

Nor is electricity, as a method of precise and scientific examination, at all exempt from these remarks, unless it shall have been made use of by those who are perfectly conversant with it in all its details, and with the numerous fallacies which underlie its application. Years ago, when railway injuries were more often the cause of litigation than they are now, it was by no means uncommon for evidence to be given in court that the "electric test," as it was called, had been applied, and that the patient, because he could not feel, was of necessity suffering from incurable central disease. Scientific evidence has happily improved, and it is recognized now that cutaneous anæsthesia has no such deadly meaning, and that in order to make proper use of electricity in diagnosis it is essential to exclude those states of the skin, which prevent the reaction of the muscles being determined by application of electricity to them through the cutaneous surface. For when patients have been long confined to bed, and from one cause or another, from genuine fear of moving, from a supposed inability to move or from a resolve not to move, have kept their legs at rest, there is likely to be considerable diminution or even loss of cutaneous sensibility. The "electric test" is, of course, useless in such circumstances, and because there is no response it is altogether erroneous to conclude that there is grave organic disease. We may perchance have to do with a case of hysterical anæsthesia, and we must look to accompanying conditions to help in diagnosis. The reflexes are present, there is no trophic disturbance in any part of the limbs, and above all, if the electric stimulus be brought into contact with them, either directly by needles, or after proper preparation of the

skin, it will be found that the reaction of the muscles is quite natural. Hear what Dr. Buzzard has to say on this point. After describing a case of hysterical paralysis, he writes: "In this case, as I have seen in many belonging to the class of hysteria [the very cases that are so often seen after railway collisions, functional disorders of motion and sensation, and occasionally real imposture], the epidermis, which had arrived at extraordinary thickness, apparently from disuse of the limbs, offered great resistance to the passage of electric currents. In these circumstances a more than usual amount of care in thorough soaking and rubbing of the skin, as well as in selecting the motor point, is necessary in order to avoid fallacies." ("Clinical Lectures on Diseases of the Nervous System," p. 118, Lecture V., "On the Differential Diagnosis between certain Hysterical Conditions and Myelitis.") The difficulties involved in the application of electricity are well indicated by the same author in a passage worthy of quotation: "We never see in hysteria the various muscles of one limb showing differing degrees of abnormality in their response to faradaism, from a condition of total absence of reaction in some, to nearly a natural state in others. Moreover, in hysteria, according to my observation, applications of electrical stimulus (and especially of the voltaic current) on one or two occasions usually suffice to restore the natural excitability of the muscles (equally in all) which has simply declined through disuse. A difficulty can only arise where the observer has but one opportunity of testing the electrical condition, and it is then quite possible to occur. It must be remembered that, as a distinct lowering of faradaic excitability almost invariably signifies organic change in a nerve trunk or centre, a diagnosis of hysteria can never safely be arrived at while that condition persists. On the other hand, I need scarcely remind you that the preservation of a completely normal faradaic excitability in the muscles of a limb does not show that that limb is not paralyzed. . . . In cases of paralysis, it is only when the integrity of the gray matter of the anterior horn is disturbed, or when there is some lesion of the anterior root or trunk of the nerve, that you find decided loss of electric excitability. You frequently meet with complete paraplegia and yet all the muscles will respond normally to electric currents" (op. cit., p. 100).

In the use of electricity for diagnostic purposes, therefore, we must not be content with the negative evidence merely of cutaneous insensibility, or absence of response in the muscles: we must look for some such indication as is given by the reaction of degeneration, or by the different reactions of various muscles in the same region. If these and similar points are borne in mind there will be little likelihood of the electric test being vaunted as an infallible witness in a court of law, and the real position of electricity as a means of diagnosis will be less liable to be shaken by conflict of testimony.

Conflict of testimony, in other words differences of opinion, must inevitably arise in many cases of injury or disease, and the maladies considered in this book are not exempt from it. It might be well, perhaps, when litigation has been resorted to for the settlement of the pecuniary compensation, if medical men were to be freed from the necessity of giving evidence on medical matters in open court. I do not intend, however, to say what are my views upon the subject in this place, nor how in my judgment the practice of the courts might be improved. Suffice it that testimony has still to be given in court, and that in giving it the medical witness ought never to forget that the reason for his evidence is to enable the court to arrive at a just and impartial conclusion. If he is himself a partisan, it is obvious that his testimony is of small value for the purpose named; and of one thing he may be certain, that, if a partisan, he is tolerably sure to reveal his bias almost as soon as he opensh is mouth, and that his testimony will be estimated accordingly. Judge and jury will alike put it aside. "Expert testimony" ("North American Review," 1884, p. 609, "Expert Testimony," by W. W. Gooding, quoted from Dr. Wilbur, of Syracuse, N. Y.), it has been well said, "should be the colorless light of science brought to bear upon any case when it is summoned. It should be impartial, unprejudiced. There should be no half truths uttered, and suppression of the whole truth is in the nature of false testimony." It is true that our present methods render the position of the doctor very often difficult, for the warfare of counsel and the arts of cross-examination tend to throw into strong and undue relief the slightest differences of opinion, and lead too often to the witness saying more or less than he intended to say. Patience, impartiality, good temper, a sense of justice, and a

single purpose to give utterance to the truth—these and, not less than these, a sound knowledge of the matter on which evidence is being given—will together be his best protection in the witness-box, and will make the taunt that doctors differ absolutely harmless to him. This is what Chief Justice Clinton said on the evidence of medical witnesses in courts of law ("Buffalo Medical and Surgical Journal," Jan. 1st, 1880): "As to the delivery of testimony by you as experts, I have very little to say that might not just as properly be said to a witness who is called to testify only as to the facts of the case. The difference rests in this: the expert, as such, is asked only for his opinion upon the facts. He may be asked his opinion upon a hypothetical state of facts, and required to give reasons for the opinion he expresses. The cross-examiner is allowed great latitude, and I am sorry to say not infrequently abuses it. But if the witness will only remember the worth and dignity of his profession, and that he is there simply to speak truth, as a servitor of justice, no arts or sneers of counsel can disturb him. Calm and self-possessed, he will answer every question, direct or cross, fully and in the plainest and most lucid language in which the meaning of the answer can be conveyed to the jury. To such an answer he will add nothing, unless it be a necessary explanation. He will not air his learning before the court, nor have any the least contention with counsel. The court will, if need be, protect him from the abuse of lawyers. Such a witness will return from the stand as calmly as he went upon it, approved by his own conscience, and respected by the court, the jury, and the bar."

CAUSES AND PREVENTION

OF

PHTHISIS.

BY

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THE CAUSES AND PREVENTION OF PHTHISIS.

CHAPTER I.

PATHOLOGY AND AFFINITIES OF TUBERCLE.

Tubercle, in its various forms, at the present day, carries off annually nearly 70,000 persons.

In the form of phthisis, at ages between 15 and 45—the most useful stages of human existence—it kills more than one-third of the people who die, and nearly half between 15 and 35.

Moreover, in its prolonged and painful course, it either prevents its victims from earning their livelihood, or at least interferes greatly with their daily work. Its habit of seizing upon the flower of the population; its slow, but, in the majority of cases, almost certain, progress toward death; the distressing weakness and suffering of the last few weeks or months of existence; all these are features in the fell disorder that render its study all-important, not only to medical men, but also to statesmen, and to all who are concerned with the welfare of the nation.

It is, perhaps, hardly necessary in the present instance to defend the thesis, that phthisis is both curable and preventible. A great change has of late years been wrought in medical opinion upon this subject. Up to quite a recent period, not only was consumption supposed to be incurable, it was also regarded as almost inevitable. Families in which existed a taint of the disease were supposed to be doomed to lose some of their members from this cause. Insurance offices still refuse to enroll upon their books those who have lost a father and mother from the disease; and even collateral relatives, who have died from it, are judged to have an influence upon the candidate for assurance.

The fate of the consumptive himself was also generally

regarded as hopeless. It must be in the memory of most of my readers to have seen the recognition of even the early stages of tubercular disease regarded as equivalent to a sentence of death, and the dictum of Sir Thomas Watson, that "tubercular disease, when established, is beyond our power,"[1] was currently accepted as the truth.

These views of the inevitable character and the incurability of phthisis are now altered. Thus Niemeyer remarks:[2] "Many a patient gets well who would formerly have been assumed to be the victim of tubercular, and therefore incurable, disease." Dr. Pollock shows[3] that "many cases which were given up by doctors, but outlived the prediction to arrive at old age, were undoubtedly recoveries from phthisis. Many more were instances of an early invasion of the disease, with subsidence of, and long toleration of, the deposit;" and again (p. 17), "the best authorities lean to the opinion that tubercle is capable of removal by absorption."

In his work on pulmonary consumption (p. 324), Dr. C. T. Williams gives, as the result observed in private practice, that "a cure was effected in 4.6 per cent of the cases; great improvement in 38 per cent; the disease was stationary in 13.4 per cent; but in 43.5 per cent there was more or less increase."

I have myself a list of more than 40 persons, who have been under my own observation for many years, in whom the disease has made no progress and who may therefore be considered as practically cured.

The evidence derived from post-mortem examinations of adults who have died of other diseases than phthisis, also shows that a very large percentage of persons have suffered and have recovered from tubercular disease of the lungs.

My colleague, Dr. Harris, has himself investigated this subject, and found that in at least 39 per cent of the autopsies at the Manchester Royal Infirmary, there was evidence of cured phthisis. He also refers (in a paper on the curability of phthisis)[4] to the researches on this point of Cruveilhier, Rogée, and Dejerini, 50 per cent of their cases having shown signs of caseous and calcareous formations. Bollinger, in 256 similar cases, found 27 per cent with evidence of healing; Standacker, 26 per cent; and Marsini, 39 per cent. Evidently a very large proportion of our population suffers from tubercular disease and recovers from it.

With regard to the preventibility of the disease, still less can any doubt prevail. In the last 30 years, if we take the returns of the Registrar-General as our authority, the annual rate of mortality from phthisis has been reduced by more than one-third. In the three years 1858–60, the rate per million of persons living was 2,567, in 1888 it was only 1,541, a diminution of more than 1,000 per million, and, if we take the population as over 29,000,000, this means a saving of about 30,000 lives every year, from this cause alone.

Nor is this improvement confined to England. "In 1857, 39.50 deaths from consumption were returned in the State of Massachusetts for each 10,000 of the population; in 1883, only 29.90. This decrease is too large to credit to greater accuracy in diagnosis and to the transference of consumption to other States, and is mainly attributable to the prevention of phthisis by improved hygiene." [5]

Evidence has been also forthcoming, of the strongest kind, of the influence of sanitary measures, and especially of good drainage and good ventilation, as preventive of consumption.

No better instance of this could be found than in the records of the mortality from the disease in the British army and navy. This evidence was collected by the commission on the sanitary state of the army, 1858, and the results are shown in the following table, which has frequently been quoted before, but which can hardly be too often brought before public notice. This mortality is given at several stations for several successive periods, and I think that you will be at once struck by the enormous death-rates among the troops in the earlier periods and at every one of the stations, and the great reduction of the rate in 1874. At the present time it is still further reduced. In 1883, it was only 6.28 per 1,000, and throughout the world only 9.57.

TABLE I.—*Mortality per* 1,000 *of strength.*

	1830 to 1837.	1837 to 1847.	1863 to 1872.	1874.
Household cavalry,	14.5	11.1		
Cavalry of line,	15.3	13.5	9.17	8.79
Foot guards,	21.6	20.4		
Mediterranean stations,	21	16.4	11.2	7.27
Canada, etc.,	23	17	9.49	6.0
Jamaica, etc.,	91	59	17.5	16.9
Madras, India,	52	—	24.2	14.22
Bengal, "	44			
Ceylon,	49	—	21.95	6.04

Rates of mortality at the same ages prevailing in healthy country populations,	7.7
In England and Wales,	9.2
In Manchester,	12.4

The greater part of this excessive mortality was due to consumption. Dr. Buchanan, now medical officer to the Local Government Board, has also shown conclusively that good drainage of a locality may diminish by one-half the prevalence of the disease, as in the case of the city of Salisbury.

These instances may suffice to show that we are entering upon no barren quest in searching for means, to reduce still further the mortality from consumption.

So much has already been said upon the subject, that it might well seem somewhat presumptuous in me to attempt to re-tread the path that has already been opened up, and so well explored, by men like the two Williamses, Southey, Ancell, Treves, and a host of others.

Every organ and every structure of the tuberculous subject has been carefully examined, weighed, and measured. Their tissues have been searched for abnormal signs, and analyzed to discover alterations in their chemical composition. The blood and all the fluids have likewise been scrutinized by the aid of the microscope, and subjected to chemical research. The functions of the living body have been watched in all their phases—in brief, all the forces of the animal economy have been reckoned up, and the special pathology of tubercle thoroughly searched out.

But medical science does not stand still, and since most of the work thus alluded to was performed, great additions have been made to our knowledge of the subject.

Koch's great discovery alone would have rendered it desirable, and even necessary, to pass under review the older researches into the etiology and prophylactic treatment of consumption.

It is now eight years since Professor Koch succeeded in demonstrating the existence of a specific organism in all tubercular diseases. By pure cultivations of the bacillus, and by numerous experiments upon animals, he may be said to have fully proved its essential relation to the disease.

But, notwithstanding the confidence inspired by the character and methods of the discoverer, some little time was

needed to establish the truth, and to obtain confirmation of his observations by others.

The early years after a great discovery are often thus taken up with its verification and its application to previously ascertained facts. The master-builder has laid a head corner-stone, and other minor workers are busily engaged in raising other portions of the edifice to its level.

Such an epoch is now before us, and the full effect of Koch's great discovery, upon our estimate of the secondary causes of phthisis, has even yet hardly been correctly ascertained.

The earlier years after 1882 were, in fact, mainly occupied with the researches of rival pathologists. Aufrecht, Spina, Klebs, Schottelius, Eberth, Malassez, and Pignal, and many others, discussed the essential influence of the newly-found organism, and the possibility of zooglœa-like forms of tubercle, or of pseudo-tubercle.

Clinical researches were undertaken in all countries, notably in England by Watson Cheyne, Dreschfeld, and C. T. Williams; in France by Chantemesse, Duguet, Gosselin, Héricourt, and Warlomont; in Italy by Celli, Cavagnis, Guarnieri, and Voltolini; in Germany by Baumgarten, Biedert, Langerhans, Veraguth, and a host of others.

Numerous experiments on the inoculation of tubercle bacilli were undertaken, and researches were made as to the presence of the virus in milk and other foods, in the air, in dust, in walls, and even in house-flies. Some of these will have to be reviewed later on. On the whole, it may be said that Koch's position has been only more firmly established by these observations, and that it must be acknowledged that, whatever may be its mode of working, the tubercle bacillus is the specific cause of the disease.

I can hardly hope to add many stones to the still unfinished work; but at least it may be of some advantage, to attempt to bring into one field of view the various facts bearing upon the natural history of the organism, its favorite haunts and breeding-grounds, the soil most favorable to its growth, the food that will nourish it into virulence, and, most important of all, the conditions under which it may be robbed of its power for evil.

One consequence of the successful search for the vera causa of tubercle, and that perhaps not the least important, is, that

it thrusts aside all former speculations as to the nature of tuberculous growths.

There is now no need of learned and elaborate inquiries as to whether tubercle is "a blastema, coagulating near the vessels from which it exudes,"[6] or "a deposit of specific tubercle cells,"[7] or "a retrograde metamorphosis of tissues,"[8] or "a lymph-tumor, a new growth arising out of connective tissue by endogenous multiplication,"[9] or "a retention in the blood of degenerate substances,"[10] or "lymph, malformed, oxidized, and precipitated from the blood upon contact with air."[11] All these surmises are now of interest mainly as matters of history. Scrofula and phthisis have also been shown to be due to one and the same cause. Lupus is recognized as tubercular disease of the skin; and the various forms of tubercle itself are seen to be due, primarily, to the extent of the irritation caused by the presence of the parasite and its products; secondly, to the efforts made by the surrounding parts to resist the invader.

The essential pathology of phthisis may, in fact, be stated very briefly. Dr. C. T. Williams says: "Reaching the alveolus through the breath, the bacillus enters the epithelial cell and causes proliferation by irritation. The alveolus becomes stuffed with cells, and if the irritation be a gradual process, it gives rise to a highly nucleated product in the giant cell. If the irritation be great, caseation is rapidly produced, though whether this be due to necrobiosis from overcrowded proliferation, or, as Dr. Watson Cheyne thinks, to a chemical change in the cells, brought about by the action of the bacilli, is not yet determined."[12]

Dr. Watson Cheyne himself says: "Bacilli are inhaled into the air-cells of a lung which is in a fit state, whether by predisposition or otherwise, for their growth. They at once attack the epithelial cells, and, in the first instance, cause their hypertrophy and multiplication. The bacilli growing in these cells produce poisonous chemical substances, and the cell which in the first instance was stimulated to increased growth by a small quantity of the poison, soon succumbs to the increasing amount and undergoes caseation. Some cells, or groups of cells, are, however, stronger than the others, and go on growing so as to form giant cells. These generally ultimately succumb, though in some instances they may get the

upper hand, and the bacilli may disappear. While this is going on, inflammation spreads around, and the process crosses from air-cell to air-cell. I believe also that this view of the production of a poisonous substance by the bacilli may explain the fever and wasting of phthisis." [13]

These observations are also confirmed by others. For instance, Veraguth,[14] as a result of his experiments on the inhalation of tuberculous sputum, notes that the first change to be seen is an increase in the number of tubercle bacilli in the alveolar epithelium, with consequent desquamation; then, later on, hyperæmia with migration of white blood-corpuscles into the alveoli, and a reactive increase in the neighborhood of the disease focus, which tries thus to keep off the bacillus by encapsuling itself.

Through the presence of the bacilli caseation takes place, the central portion of which dies. Only, on the periphery of the diseased focus, within epithelioid or giant cells, certain tubercle bacilli or spores are preserved, which later on enter the neighboring lymph-tracks, and set up fresh foci in the interstitial connective tissues and in the lymph-glands.

Baumgarten has even watched the development of epithelioid and giant cells,[15] and describes the so-called epithelioid cells as arising from the action of the tubercle bacilli on the fixed cells of the connective tissues, or on the epithelium. "Out of the epithelioid cells," he says, "the giant cells proceed. An increase of the nuclei takes place in them, while the partition of the cell body is omitted. This happens the more frequently the fewer there are of the tubercle bacilli, and the weaker their power of growth. If, however, an abundance of these bacilli are present, or their power of growth is increased, an irritation is caused in the walls of the vessels, and the white corpuscles migrate, and gradually supplant the epithelioid cells, thus taking the upper hand in building up the disease already commenced." [16]

Weigert [17] also confirms this story of the formation of the giant cells, by noting that there is a partial proliferation of the cell nucleus, while the body of the cell does not divide; then, in consequence of a partial caseation of the cells, the protoplasm is held together by the dead, and apparently degenerated, portions of the growth. Hence, the tubercle bacilli lie, not in the centre of the cell, but in the neighborhood of its

nucleus, because through the caseation of the protoplasm they go to the ground, but in the proliferating zone they can sustain and increase themselves.

It is thus plain that Dr. Williams' account of the relationship of the bacillus to the pathological changes in tubercle is fully borne out by these observers, and that a clear and intelligible histology of the disease has been worked out. In Ziegler's words, we must "regard tubercle as an inflammatory product, the result of an irritation, an infection;"[18] and, as we have seen, such constant association of the bacillus with the lesions of phthisis by no means excludes the possibility, often insisted on, of the secretion or production by its means of certain unorganized morbific material.

Dr. Watson Cheyne attributes much importance to this secretion, and Dr. Wilson[19] says: "The constitutional manifestations of tuberculosis are not directly due to the bacilli, but to toxic principles evolved during their growth and multiplication." He quotes Nencke's chemical analysis of tubercle bacilli, and his separation from them of a tetanizing poison; also Bonardi's demonstration in tuberculous sputum of certain organic bases which caused disturbance of the nervous system when introduced into rats and Guinea-pigs.

Dr. Coats, in his "Lectures to Practitioners" (p. 185), seems also inclined to infer that it is not the bacilli themselves, but their products, that are harmful. "They are minute vegetable bodies," he says, "which multiply along surfaces or channels, and do not usually penetrate into the living tissues. Such minute bodies cannot, by their merely physical properties, produce any serious damage. It must be rather that, in their growth, they evolve certain chemical principles which are injurious to the tissues." He adduces, in proof of his contention, the fact that, in tuberculosis of the peritoneum, you have the flat yellow caseous tubercles buried in new-formed connective tissue, which is fully organized, and contains blood-vessels; "it is the diluted products of the bacilli that induce the more simple inflammatory lesions." Pleuritic infection in phthisis he considers to be due to the same cause, and that a good deal of the inflammatory lesion in the connective tissue of the lung itself is of a similar nature.

These brief remarks may perhaps suffice as a statement of modern views respecting the pathological histology of tubercle.

It is also unnecessary, in the present instance, to recapitulate at length the characteristic points connected with the development and growth of the bacillus. They were so fully made out by Professor Koch himself that scarcely any addition has been made to our knowledge in this direction. For our present purpose, it will be sufficient to recall to our minds (1) the small range of temperature within which the organism can be successfully cultivated (between 84° and 107° Fahr.); (2) the length of time, from two to three weeks, required for its development; (3) its tenacity of life in sputum, Fischer and Schill having found it virulent after 43 days in putrefying sputum, and 186 days in sputum dried at ordinary temperatures; (4) the observation showing the antagonism that exists between the living elements, especially the wandering cells, the leucocytes of the body, and the bacillus—observations tending to show that, as a rule, the organism has a short life within the body, and that it can only maintain its presence, for any length of time, by the appearance of new generations to fill the places of the dying.[20]

The histology of tubercle being thus clear, the reason for its spreading infectively through the system has also been made plain. It hardly needed Koch's demonstration of the bacillus, to show the track by which it usually makes its way. A close relationship between the lymphatic system and tubercle had already been clearly shown by many observers, such as Virchow, Wedl, Rindfleisch, Wagner, Aufrecht, Buhl, Burdon-Sanderson, and Treves.

Thus Rindfleisch[21] pointed out that "specific irritation of the endothelia of the lymphatics, the serous membranes, and the blood-vessels, is the essential factor in the production of the miliary nodule, and it is only because the lymphatics run by preference in the immediate neighborhood, in the adventitia of the blood-vessels, that miliary tubercles exhibit a preference for that locality."

Aufrecht regarded miliary tubercle as "a granular perilymphangitis."

Wagner speaks of "the extension of tubercle . . . in the course of lymphatic vessels, or in that of blood-vessels."

Treves looks upon tubercle as infective, and affirms that "lymphatic structures of some kind are essential" to its formation.

Buhl [22] goes still further and says: "Tubercle extends from the internal wall of the alveoli into the textureless lymphatic vessels."

These ante-bacillary observations are only confirmed by the researches of Koch, and by such men as Baumgarten, Fischer, Volkmann, and others.

Also the mode in which the bacillus gains access to the system was noted long before Koch's time. It was recognized that the points of attack selected by the disease indicated that the infection comes from without the body. Thus Cohnheim, in his work "Die Tuberculose vom Standpunkt der Infectionslehre" (p. 20), shows that a tuberculous or scrofulous product is mostly deposited in those parts of the body that are either most exposed to attack from without, or in which any virus coming from the outside may lodge for the longest time. Thus no internal organs are so constantly brought into relation with the atmosphere as the lungs, and accordingly no other organ is attacked by tubercle with the same frequency and the same intensity.

In many cases of this disease also all the other organs, not connected with the lungs, are free from its attack.

Such a fact as this could not well be accounted for on any other supposition than that of a primary and immediate attack upon the respiratory tract by the virus. Next in order to the lungs and pleuræ, and to the bronchial and tracheal glands, come the glands about the pharynx; and then, next after these, owing probably to the swallowing of sputa, we find the lymphatic apparatus of the walls of the intestines, the isolated and agminated follicles, most liable to be the seat of tuberculous ulceration. The œsophagus escapes contagion because of the rapidity of the transit of the virus, and the stomach, perhaps, owing to the presence of the gastric juice. Through the intestinal ulcers a path is opened to the mesenteric glands, the liver, and the whole of the rest of the body, thereby producing general tuberculosis.

The demonstration by Koch of an organism that must in most cases come from the air, and that could in this way penetrate the lungs, or enter the lymphatics by sores, only served to make assurance doubly sure. The vehicles of the virus were indicated. Tubercular bacilli were found by Koch in dried and powdered sputum, by Cornil in the walls of rooms,

by Dr. C. T. Williams in the air brought by ventilating-shafts from a ward in Brompton Hospital, and by myself, though rarely, in the aqueous vapor condensed from the breath of patients in an advanced stage of consumption, and this latter observation was confirmed by Dr. C. Smith by means of gun-cotton respirators. (Some doubt has been cast upon the possibility of bacilli being found in the breath, especially by Dr. Cornet ("Berliner Mediz. Woch.," 25 März, 1889, p. 250). He adduces as grounds for disbelief the considerations, 1, that non-volatile substances could not be exhaled; 2, that many competent observers have failed to find them; 3, that errors may have crept into the observations. To these objections I would reply: 1. That any one who will examine microscopically the condensed aqueous vapor of the breath may soon convince himself that it contains much non-diffusible organic matter, such as epithelial scales, etc. (see paper on "The Organic Matter of the Breath," "Jour. of Anat. and Phys.," IV., 209). 2. To the observations named by Dr. Cornet must be added those of Dr. G. Heron, who informs me that he also was unable to find bacilli in tubes and watch-glasses exposed for long periods to the breath of phthisical patients. But there is nothing surprising in the fact that such negative results have been obtained. I found no bacilli, in some cases, in the deposit from several drachms of condensed aqueous vapor, and very few in any case. 3. The fact that the bacilli were so few in number is of itself a tolerably sure proof that no contamination by sputum had taken place, owing to the precautions taken to prevent this accident.) The point of usual entrance of the organism was also demonstrated.

Professor Klein followed the development of tubercle from the "epithelial cells of the alveoli," and, as we have seen, Dr. Watson Cheyne confirmed these observations by finding that the principal seat of the specific bacillus in the lungs is the alveolar epithelium, and its products—*i.e.*, in the epithelioid cell and the giant cell.

Another important result of Koch's discovery is that in placing tuberculosis undoubtedly among the class of microbic diseases, it imposes upon us the task of determining its affinities and assigning to it its place among other such disorders.

It was suspected long ago that tubercle bore a close relationship to some of the infective class of diseases.

Without laying any stress upon the ancient guess that consumption is due "to animalcules in the lungs,"[23] it was proved by Villemin in 1865 that tuberculous material would convey the disease to sound animals, when it was introduced into their bodies by puncture or inoculation, and his results were shortly afterward confirmed by others. Moreover, animals fed with this material contracted the complaint, and the inhalation of dried and pulverized sputum from consumptive patients caused the disease in dogs and other animals.

Many observers were also on the look-out for specific organisms, notably Chauveau, Baumgarten, Ziegler, and Zinn. Ziegler[24] plainly tells us to regard tubercle as "an inflammatory product, the result of an irritation, an infection," and he does not doubt that "schizomycetes play an important part in phthisis."

Some, as Klebs and Deutschmann, thought they had actually found a "monas tuberculosis;" Toussaint a "coccus;" Buhl and Aufrecht, "a specific bacterium."

Finally Koch's researches settled the question, and the tubercle bacillus reigns supreme as the essential specific element in the causation of phthisis and other tubercular diseases.

But even before the specific cause was established, the relationship of tubercle with other infective disorders had been suspected.

Both Villemin and Virchow compared tubercle to the granulations of glanders, and the gummata of syphilis; and though the former separated scrofula from tubercle, he points out that they both share with syphilis, glanders, and typhoid fever, the character of forming caseous material. Klebs and Cohnheim also pointed out the similarity existing between tubercle, glanders, syphilis, lupus, pearl disease in cattle, and even lepra, and they regard them as closely allied in all essential points of their anatomical structure and history.

In his Gulstonian Lectures on Tubercle, Dr. Southey also showed that typhoid lymphomata are very like tubercle, both in their composition and their course, affecting similar parts and leading to like lesions. He places tubercle between cancer and these and other lymphomata.

Dr. Southey goes so far as to suggest that tubercle in its acute form may even become epidemic, and he cites, as in-

stances, of this form, some cases recorded by Dr. Léon Colin in his paper on "Tuberculization Aiguë. This view is, however, scarcely supported by the facts. I have read this paper, and find that his cases are mostly those of young soldiers who had recently joined their regiments, and M. Colin himself especially points out that they may all have been the subjects of chronic phthisis before they came out, and the change from a temperate northern climate to a Mediterranean station had produced a sudden outbreak of acute disease. He does not suggest that it was a true epidemic, and he adduces the English army statistics as bearing witness to the danger of transferring men of northern climates to hot climates. The likeness to an epidemic is thus reduced to an accidental lighting up of the disease in an acute form by the influence of a hot climate.

Tubercle, then, can only be said to be allied to ordinary epidemic diseases in the sense that they are all parasitic disorders.

It may rather be regarded, like leprosy, as a type of an endemic disease. Dr. Guy, in his work on "Public Health" (p. 42), when defining epidemic maladies, expressly singles out consumption as a "non-contagious, domestic disease," and, to point his remark, he refers to the very slight fluctuations in its rate of mortality, and says: "If, then, any one were to assert that this disease is contagious, which is tantamount to saying that it may be epidemic, the figures I have quoted would in themselves furnish an answer in the negative."

It by no means follows, however, that a disease need be contagious or epidemic because it is derived from without the body, and because it afterward travels infectiously along the channels of absorption, or of circulation. Although infective, it need not be infectious, and may be incapable of being conveyed directly from the body of one patient to that of another. The discussion of this question as regards phthisis must be postponed until later, but it may be sufficient for the present to point to intermittent fever, as an instance of a disease which, though non-contagious, is essentially infective and connected with a microbic parasite.

Whether contagious or not, phthisis is sharply marked off from ordinary exanthematous disorders, not only by its specific micro-organism and by its endemic habit, but also by its usually slow and creeping and irregular course, and by the

permanent growths and alteration of structures and destruction of tissue that are brought about by the bacillus.

The exanthemata, on the other hand, are acute in their type, they run a rapid course and have certain definite and fixed periods of incubation, of inflorescence, and decline. They seldom attack the same person twice, though they are highly infectious for the most part, and after visiting a people for a time, they depart almost completely, until, in fact, a sufficient density of susceptible persons has grown up to permit them to regain their epidemic character. Lastly, they seldom leave behind them permanent growths which tend to spread destructively through the tissues.

We can thus mark off, as alien to tubercle, a large group of microbic diseases, even including those already mentioned as leaving lesions somewhat similar in character to tuberculosis, such as enteric fever and acute glanders.

In searching for the diseases kindred to tubercle we must look for those which are chronic, endemic, irregular in their course, and produced by the action of a micro-organism which is of comparatively feeble power of irritation, but which nevertheless brings about inflammatory action, tending to produce permanent changes and necrosis of the tissues, and travelling along the track of the lymphatics or in the currents of the blood.

Chronic glanders, or farcy, includes most of these points of resemblance. It is produced by a bacillus discovered by Drs. Löffler and Schütz, which has been best cultivated in blood-serum and isolated, and which produced the specific disease by inoculation into horses, Guinea-pigs, rabbits, and field mice. The farcy buds and nodules caused by its presence are found not only in the nostrils, but also in the larynx, trachea, and lungs, and they closely resemble tuberculosis in their appearance and in their structure. It has also been known to attack the nervous system. Like scrofula, it produces intractable ulcers of the skin and mucous membrane and affections of the joints. In some cases the chief symptoms are cough, with sanguineous expectoration, hoarseness, fever, and emaciation, so that it may well be mistaken for phthisis.

It is a contagious malady, but it has been found to be subject to predisposition, and susceptibility to it is enhanced by unhealthy conditions of life, impure, re-breathed air, cold and damp being especial factors in the result.

A close affinity to tuberculosis may also be traced in such diseases as actinomycosis, framboesia or yaws, and in the fungus disease of India, or Madura-foot.

The origin of two of these disorders is, however, too obscure to allow us to catalogue them in due order. It is even doubtful whether the fungus found in the dark variety of mycetoma is essential or adventitious, and framboesia is more acute in its course than most forms of tubercle.

Actinomycosis, however, presents many features in common with tubercular disease. It is characterized by the formation of nodules, somewhat resembling tubercular growths, and showing, perhaps, some relationship in their mode of production.

In the centre of these nodules are the specific club-shaped corpuscles, the actinomyces. As the nodule grows, a zone forms around it of large, nucleated cells, not unlike giant cells in appearance. These are surrounded by exudation-corpuscles, and these again by a capsule of fibrous tissue. These inflammatory nodules ultimately coalesce, and gradually form large tumors, but while still scattered and small in the lungs they much resemble tubercles. There is also in actinomycosis a greater tendency to suppuration.

Cohnheim remarks (p. 743): "We find in actinomycosis all the essential criteria which are characteristic of the infective tumors."

Actinomycosis also would seem to preserve a somewhat endemic character. It has been observed by Claus that in Bavaria the cattle affected by it were chiefly confined to three districts.

At present, however, it is chiefly an epizootic disease, affecting cattle rather than mankind, and, moreover, the organism causing these lesions belongs to an order distinct from the bacillus of tubercle. Technically, it is allied to the hyphomycetes, similar to aspergillus, or the pébrine of silkworms, the saprolegnia which causes salmon-disease, the oïdium of vines, and of favus, ring-worm, and thrush. In spite of its infective character, therefore, and of the somewhat similar nature of its course and the injuries it inflicts, it cannot be placed in the same order as tuberculosis.

But it must be acknowledged that the closest resemblances are to be found between tubercle, syphilis, and leprosy. (Per-

haps at some future time, when the microbe of cancer has been made out, this disease may be added to the group.)

All these disorders are of microbic origin, they are capable of varying degrees of intensity, and possess the power of renewing their ravages after varying periods of dormancy; they produce growths that are strikingly similar in pathological characters, and they either are or have been universal in their distribution apart from considerations of climate, race, and habits of life.

Syphilis, it must be admitted, is, in certain points, more like an exanthematous disease than it is like tuberculosis; thus, it is highly contagious, and is not very discriminating in its victims. It does not usually recur, it has a fairly definite period, and has a number of distinctive rashes, and in its initial stages is usually acute in its manifestations.

Nevertheless, if we can trust the researches on this point, a matter still very doubtful, it appears to be due to a bacillus, which is capable of cultivation, and which takes a special kind of stain, and this organism apparently possesses the power of remaining latent for long periods of time. It is said to have been found in all the lesions of syphilis, and these lesions, as in tubercle, are apparently due to the slow irritative action of the organism, though they are constantly more vascular in character than true tubercle. The most prominent feature of these lesions is the collection around the vessels of round cells (? leucocytes), but in the more chronic products of the disease, epithelioid and giant cells are found. The essential part of their distinctive action appears to be due to an infiltration of the tissue, and the subsequent necrosis of the part, just as we have found it to be in tuberculosis.

When the mass of inflammatory tissue is considerable, it forms tumors which, in their earlier stages, are with difficulty distinguished from tubercles. These gummata, however, differ from tubercles in being composed chiefly of translucent, gelatinous material, which, in caseating, as it does later on, becomes tough and fibrous. They have also less tendency to soften than tubercle, though they may cause destruction of surrounding tissues by ulceration, leaving a mass of scar-tissue as their ultimate result.

Their most common distribution also throughout the body differs somewhat from that of tubercle, though when they at-

tack the lungs the diagnosis from phthisis becomes very difficult. The virus takes its course along the same channels, which is mostly along the track of the lymphatic vessels.

But of all these disorders, unquestionably the nearest approach to tubercle is to be found in leprosy. In their pathology, in their course and distribution, and in many other features these diseases show the closest relationship.

Perhaps I may be permitted to trace the resemblance somewhat in detail. It is probable that in certain points light may be reflected upon the character of the allied disease, and even if it should prove to be impossible to apply to tubercle the lessons taught by the disappearance of leprosy from the central parts of Europe, we shall at least be in a stronger position when we come to treat upon the preventibility of tubercle.

1. A micro-organism is closely associated with each disease, and the bacillus of leprosy is so similar in appearance, and in its reception of staining fluids, that the most accomplished bacteriologists can find little or no difference in appearance between it and the bacillus of tubercle.

It has indeed been said that the bacillus leprae receives the stain rather more readily, but even this statement does not always hold good, and it has been proved that the human tubercle bacillus is longer in being colored than the artificial cultures of this same organism; and Baumgarten comes to the conclusion that, both in their morphology and their staining, they cannot be distinguished. He grants, however, that they produce decidedly different nosological results. (Koch points out, that "although the bacillus of leprosy can be stained by the same method as the tubercle bacillus, the contrary does not hold good. The former, as Neisser has shown, stains by Weigert's plan for coloring nuclei, but not the latter. So that, although the two kinds of bacilli resemble each other in form, size, etc., it is always possible to distinguish them by trying Weigert's color-reaction."—Syd. Soc., I., 85.)

The bacilli of lepra are also found in much larger proportion in the diseased tissues, than those of tubercle. Moreover, hitherto it has not been found possible to produce the disease by inoculations with the organism, although tissue-implantation has recently been successfully performed. Pure cultivations of lepra bacillus cannot be obtained. Evidently, while

there is a strong likeness between them, we can hardly agree with Dr. Daniellsen, who boldly says: "On ne peut indiquer un signe certain qui permette de différencier le bacille lépreux du bacille tuberculeux."[25]

2. Leprosy is like tubercle in its mode of attack. The entrance of the virus takes place at the most exposed portions of the body. As in phthisis the atmosphere conveys the bacillus to the air-passages, and in scrofulous glands to the nearest sore; so in leprosy, contagion takes place first on exposed parts—the bare hands and face—and in countries where the feet are uncovered these are the first to receive injury. The unshod Japanese are especially liable to the disease.

Some previous injury is also necessary: the epidermal covering forms a varnish impenetrable by the parasite.[26]

3. After its entrance into the body, leprosy is usually very slow in its progress, creeping infectively through the body, often with long intervals of latency, in this respect also resembling tubercle. The main point of difference is the greater chronicity of leprosy, which lasts on the average ten or twelve years, instead of three or four, as in the case of phthisis. Both diseases tend toward a fatal issue, but both are capable of becoming absolutely quiescent and inert for long periods.

4. The pathology of the two diseases is also strikingly similar. Although the bacillus in leprosy chiefly affects the skin and mucous membranes, the nerves and the bones, in its tubercular forms the structure of the leprous "knots" gives ample evidence that they are formed in the same way as tubercle, by the slow irritation of the bacillus. Baumgarten points out that the large, so-called "lepra cells" arise through the increase of the fixed tissue cells, while the lymphoid elements of the leprous growth are migrated, colorless blood-corpuscles.[27]

It is interesting to note, with reference to the site of leprosy, that it attacks internal as well as external organs, and that it has even been found in the lungs. On the other hand, tubercle bacilli have recently been found in the nervous system.

5. Both are distinctly endemic diseases, and they are, or have been, found in almost every country where human beings are collected together in any number.

They are equally uninfluenced by climate and temperature. As phthisis is now, so leprosy was formerly, endemic, not only in Asia and Africa—where, perhaps, it originated—

THE LEPRA HOSPITALS.
OF THE
BRITISH ISLES
DURING THE MIDDLE AGES.
Prepared by Dr J. Droschfeld
Professor of Pathology
in the Owens College Manchester
ABERDEEN
NEWBRIGGE
EDINBURGH
BERWICK
HADDINGTON
MELROSE
NEWCASTLE
HEXHAM
CARLISLE
KINGSCAVE
CARRICKFERGUS
DOWN PATRICK
DUNDALKE
IRISHOWEN HD
GALWAY
DUBLIN
HULLIGAD
LINERICK
CASHEL
WATERFORD
WEXFORD
CORK
YORK
HULL
LINCOLN
NORWICH
YARMOUTH
DUNWICH
LEICESTER
NORTHAMPTON
OXFORD
LONDON
CANTERBURY
ROCHESTER
CHATHAM
HASTINGS
BRIGHTON
SOUTHAMPTON
WINCHESTER
READING
BRISTOL
GLOUCESTER
EXETER
DEVIZES
TAUNTON
BRIDGWATER
LAUNCESTON
PLYMOUTH
TAVISTOCK
TRURO

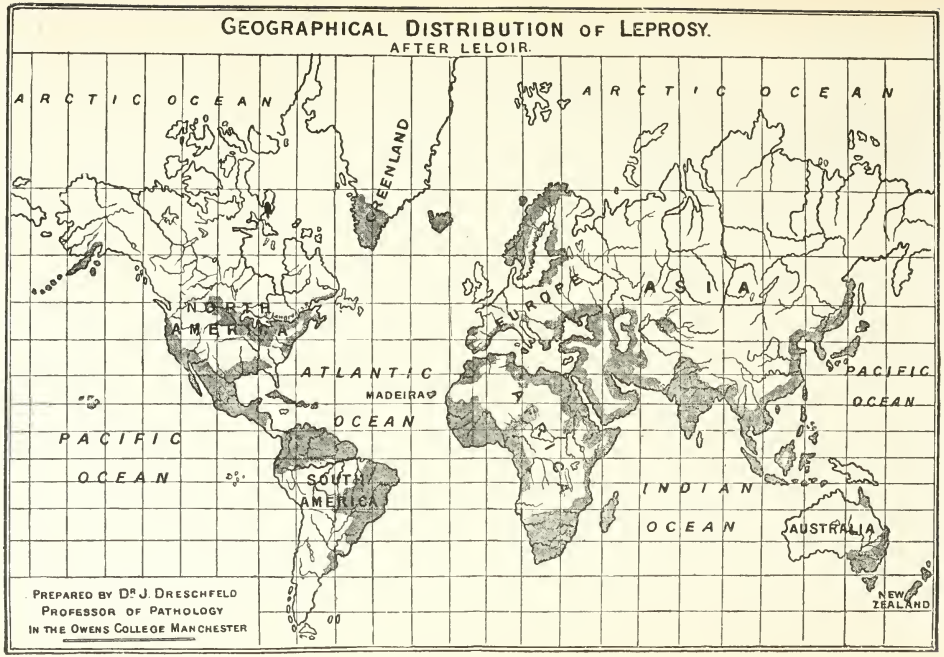
but also throughout Europe. (Raymond, in his "Histoire de l'Eléphantiase" [Lausanne, 1767, p. 106], proves that the disease existed in Lombardy in the year 603; and there is evidence that leper-houses were founded in the eighth century in France, England, Germany, and Italy. A little later Matthew Paris computed that there were 19,000 of these asylums throughout Christendom, and it is well known that in the reign of Louis VIII. of France there were 2,000 of these institutions in that country alone, which were endowed by his will. The religious orders of the Knights Hospitallers, and especially those of Saint Lazarus, were founded mainly for the care of lepers, and their chief was usually himself affected with the disease.)

I have here a map, kindly lent to me by Dr. Dreschfeld, showing the distribution of lazar-houses throughout the British Isles in the middle ages. It will be seen that they are very numerous, and so spread out through the length and breadth of the land, as to indicate a very wide prevalence of the disease.

It is probable also that many have been omitted. Thus Newcastle-upon-Tyne is not marked, and yet I have learned from Mr. Marsden Gibson, the master of the Hospital of S. Mary Magdalene, that it was originally founded for the benefit of lepers—and, perhaps, the Hospital of St. Thomas the Martyr also. The funds of many of these places have been, for the most part, diverted to other purposes. (Since this chapter was written, Dr. Dreschfeld has received several communications from medical men indicating other sites of leper hospitals, and these have now been added to the map.)

Even at the present time its presence is sufficiently manifest in the four quarters of the globe to show that it is independent of climate.

It will be seen from the map of the word that has been drawn by my friend Dr. Dreschfeld, who has kindly lent it to me, that, in Europe, it exists in somewhat large proportions in Norway, and on the Rusian coasts of the Baltic and the Gulf of Finland, and on the shores of the Black Sea. It is abundant in Roumania and parts of Turkey and Greece, in the north of Italy and on the Riviera; in Sicily and on the coasts of Spain and Portugal. Iceland is also deeply stained with the disease taint. In Africa, it will be seen to exist around


GEOGRAPHICAL DISTRIBUTION OF LEPROSY.
AFTER LELOIR.
ARCTIC OCEAN
GREENLAND
ARCTIC OCEAN
NORTH AMERICA
EUROPE
ASIA
ATLANTIC OCEAN
MADEIRA
PACIFIC OCEAN
PACIFIC OCEAN
AFRICA
SOUTH AMERICA
INDIAN OCEAN
AUSTRALIA
NEW ZEALAND
PREPARED BY Dr J. DRESCHFELD
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IN THE OWENS COLLEGE MANCHESTER

almost the whole of its vast coast. It is widely spread in Morocco, Tunis, Tripoli, Egypt, and Abyssinia; at the Cape and in Madagascar, and Upper and Lower Guinea.

In America, it exists in Greenland, Quebec, and in many of the northern and most southerly States, Alabama, New Orleans, and Texas. It is widely spread in Mexico and California. In South America, the northern and eastern portions are widely stained as far south as Monte Video.

In Asia, Arabia, Persia, Turkistan, and the coasts of China, Siam, and Japan are all more or less tinctured with it; but India is its great hotbed. In Australia, Queensland on the north, and New South Wales and Victoria in the south, are affected by it, and both Tasmania and New Zealand are darkly tinted.

It seems to have a special predilection for islands; thus, in addition to those I have already mentioned, the Grecian Archipelago is especially subject to it: Crete, Tenedos, Patmos, and Rhodes; Samos worst of all. It is found also in Cyprus. In Asia, the Philippines, the Moluccas, the Celebes, the Caroline Islands, the Mariannes, Andamans, and Nicobars, the isles of the South—Borneo, Sumatra, and Java; off America the Antilles, the West Indian islands; off Africa, Madeira, the Canaries, the Cape de Verde islands, Socotra, the Isle of France, the Seychelles, St. Helena; and Robbin Island, off the Cape of Good Hope, is made into a leper sanatorium.

In the Pacific, we have only too recently heard of its ravages in Hawaii, and it exists, though less abundantly, in Tahiti, Fiji, and New Caledonia, where it seems to have been recently introduced.

It is obvious, from this long list of habitats of the disease in the past and present, that, like phthisis, it is independent of climate, and though certain races are more prone to it than others, none are entirely exempt. It is also more common among the poor and filthy than among the rich and cleanly; but it is not confined to this class, and appears among the well-fed as well as among those who are confined to vegetable diet, and those who feed upon fish.

6. Precisely the same controversy as is now waged with regard to phthisis, is carried on as to the contagiousness of leprosy. In early times and the middle ages, in all countries, no doubt at all was entertained upon the point. In all Eastern

countries, the leper was "unclean," his clothing and dwelling were equally regarded as contaminated, and in Europe all kinds of devices were adopted to avoid contagion. (He wore a distinguishing costume, and carried a bell or clapper with which to warn those he met. He had a separate "borde" or hut, or slept under a hedge; he might not even look into any well or fountain, or drink from any stream but his own; must keep to the leeward of any one whom he might meet or speak to. He had to wear gloves when he passed over a bridge, and could go nowhere without a special license ("Curiosities of Leperdom," "Cornhill Magazine," August, 1889, p. 143, quoted from Grosley's "History of Troyes"). In the fourteenth century, they were supposed to be associated with the Jews, in a horrible plot to poison all the springs, wells, and rivers with their blood; and in 1321 a fearful masacre of them took place in France. At Chinon 160 were burnt in one day, and in Périgord and Languedoc, in a plague panic, fires were lighted everywhere, and lepers and Jews heaped thereon.)

This belief in the contagious nature of leprosy still remains in many countries, and lepers are carefully isolated in Norway, though without excessive rigor.

But the greatest differences of opinion prevail on this question among medical men.

In the report of our own College in 1860, the commission state decidedly, "that the weight and value of the evidence they furnish is very greatly in favor of the non-contagiousness of leprosy" (p. vii.), and again, "the all but unanimous conviction of the most experienced observers, in different parts of the world, is quite opposed to the belief that leprosy is contagious or communicable by proximity, or contact with the diseased." Just as we shall see presently, in the case of phthisis, they quote the experience of hospitals, and the immunity of the attendants in leper asylums.

In the discussions on this question at the International Congress at Copenhagen in 1884, the two chief exponents of the disease, Dr. Zambuco of Constantinople, and Dr. Hansen of Christiania, took entirely opposite views; the former maintaining that leprosy is not contagious, but is hereditary, and the latter, that it is contagious and not hereditary. Dr. Daniellsen, the father of research on the subject, also takes the non-contagious view, and says: "According to my observa-

tion, heredity is sufficiently proved, while I have not found one single well-proved case of infection." [28]

7. A similar difference of opinion is to be found as to the influence of heredity in both diseases. With regard to leprosy, Dr. Hansen states that of 160 Norwegian lepers, who had settled in the States of Wisconsin, Minnesota, and Dakota, none of the offspring, in some cases as far as the great-great-grandchildren, have shown signs of the disease. He points out that there could have been no question of heredity in the case of the great outbreak of the disease in Hawaii.

A recent writer on the subject, Dr. Albert Neisser, also considers that leprosy is not a hereditary disease, though he acknowledges that the susceptibility of the individual appears to be of more importance than in any other bacterial disease.

It is not surprising that, with all these points of similarity, the question should be asked, as it is by Daniellsen, whether "leprosy itself is not a tuberculous disease."

"The circumstance that the bacilli of tubercle are larger and less disseminated in the tissues," he says, "ought not to be invoked as a sufficient diagnostic characteristic. Nor can we draw any more conclusive argument from the mode of development of these bacteria."

"The manner in which infection in leprosy takes place, the long and silent period of incubation which characterizes it, recalls in the highest degree the infection of tubercle." [29]

Dr. Daniellsen further affirms that tubercular disease is more common among lepers than among the general population; but, even if this were true, the fact might fairly be ascribed to the general low state of health of lepers making them more vulnerable to the attacks of the tubercle bacillus.

This statement is, however, contradicted by Dr. A. Hansen, who, as I am informed by Dr. Stabell, of Bergen (in answer to a question of mine), states that "tuberculosis, which was formerly very prevalent in the leper hospitals of Norway, (and no doubt the patients were infected in the hospitals), is now more seldom seen, because the hospitals are now not so crowded as before. Tuberculosis, indeed, attacks lepers as it does other people, but the acute form is not more frequently seen among phthisical lepers than among other persons affected with phthisis."

On many grounds, therefore, the doctrine of identity must be dismissed. The different behavior of the two kinds of bacillus in the presence of cultivating media, their selection of certain tissues as their chief haunts, the difference in their rate of progress, and the fact that there is no special tendency toward tubercular disease among lepers, and *vice versâ*—all these considerations show that, though they are certainly closely related, yet there is no identity to be discovered between them.

At this stage it may be useful to draw certain practical conclusions from this review of the pathology and affinities of tubercle; they may assist us when we come to deal with the question of its preventibility:

1. That the bacillus which provokes the disease comes most frequently from outside the body, and is conveyed by means of the atmosphere.

2. That it requires a certain length of time, and certain narrow limits of temperature within which it can develop.

3. That when it is entrenched within its encapsulating tubercle it is placed at a distance both from the currents of blood in the vessels, and from air entering through the lungs.

4. That its life in the body is usually a short one, and that the living tissues are antagonistic to it, or, to use Dr. Moxon's words, that "the life of the bacillar parasite is difficult, easily discouraged by unfavorable circumstances, like an aphis by an easterly wind;" and

5. That the resemblance which it bears to the bacillus of leprosy may encourage us to hope that, as this latter disease has been banished from our country, so also may the different forms of tuberculosis ultimately disappear.

CHAPTER II.

THE TOPOGRAPHY AND DISTRIBUTION OF PHTHISIS.

It is not unreasonable to expect that a study of the geographical distribution of phthisis would lead us to the discovery of at least some of the fostering causes of the disease.

In the different countries of the world, the racial differences of the inhabitants are often so great, and the conditions under which they live, as to climate, food, habits, etc., are so varied that we might naturally expect to find some nations suffering more than others, and hence we might be able to lay our finger upon the peculiar circumstances that have been either favorable or adverse to its progress.

Nor are these anticipations entirely discredited by the result, though a much more thorough examination of statistics is required than might at first appear to be necessary.

Our chief sources of information, as to the comparative prevalence of phthisis, are the two great general works, Hirsch's "Geographical and Historical Pathology," and Lombard's "Climatologie Médicale;" but we are able to obtain some data from the "British Army and Navy Medical Reports," from official statistics of disease in different countries, and from various works by individual medical men.

Lombard's comparative figures are not very satisfactory, as he adopts the fallacious method of comparing the number of deaths from phthisis with each 1,000 of the total deaths, a method that gives a lower ratio from consumption the higher the general death-rate; and thus a place with double the rate of mortality from phthisis, as compared with another with the same population, may appear in the same grade with it, if only its total death rate is also twice as great as that of the latter.

Many of the other statistics are also open to objection; but in a general survey, such as we propose to make, it may, perhaps, be permissible to make use of somewhat imperfect materials.

Hirsch's tables are the most trustworthy, as he gives the mortality from phthisis per 1,000 living, and the years to which the returns apply, together with his sources of information, which are always the best that can be obtained. I have thrown his principal figures into the form of a diagram, which exhibits graphically the variations in the complaint better even than the figures themselves.

I have also a table drawn from Dr. Lombard's work, which shows the proportionate mortality in the capitals of the world.

TABLE II.—*Proportion of Deaths from Consumption to* 1,000 *Deaths at*

London	121	Rome	114
Paris	143	Milan	132
Brussels	163	Lisbon	115
Vienna	208	Athens	183
Berlin	109	New York	167
Stockholm	160	Rio de Janeiro	186
Christiania	172	Lima	171
St. Petersburg	151		

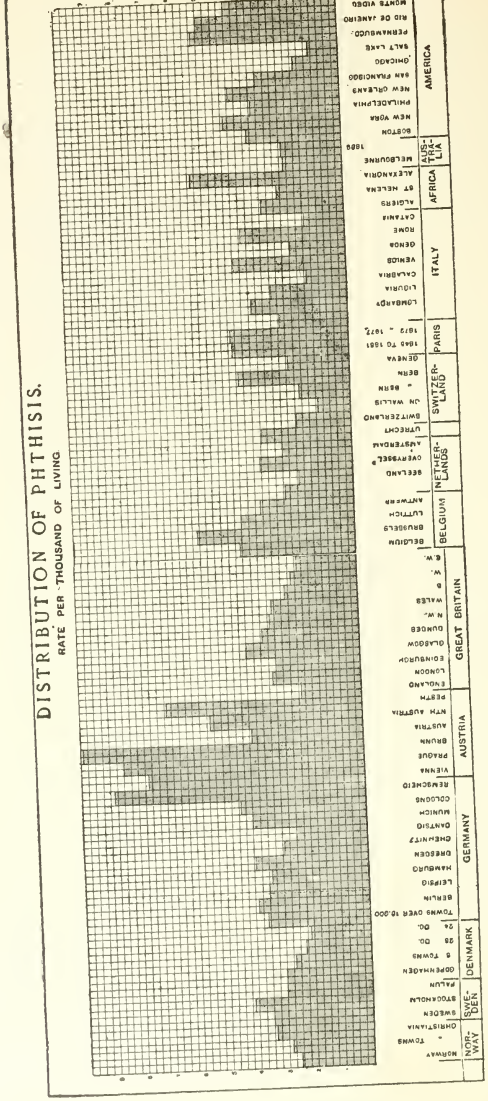
Lombard.

At the first glance at the figures placed at our disposal from these various sources, it would seem as if the expectations with which we commenced our quest were doomed to disappointment.

The disease appears upon the death-roll of almost every nation; it is everywhere present in greater or less abundance; and even if some countries appear to suffer less than others, certain places within their boundaries are to be found in which the disease exists in more than average proportion.

As both Hirsch and Lombard remark, "Phthisis is a ubiquitous malady." If we look at the map of the world which the latter provides, in which various degrees of shading are made to denote the presence of the malady in greater or less abundance, it would appear that he is quite justified in his assertion. In all climates, in the north, and in the south, east and west, however various the conditions under which men live, however much they may differ in race, in diet and clothing, and in habits of life, wherever human beings are congregated together, there phthisis is to be found.

With very few exceptions, the degrees of shading denoting


DISTRIBUTION OF PHTHISIS.
RATE PER THOUSAND OF LIVING
NORWAY
" TOWNS
CHRISTIANIA
SWEDEN
STOCKHOLM
PALUDN
COPENHAGEN
5 TOWNS
DO.
DO.
TOWNS OVER 10,000
BERLIN
LEIPSIG
HAMBURG
DRESDEN
CHEMNITZ
CANTSTD
MUNICH
COLOGNE
REMSCHEID
VIENNA
PRAGUE
BRUNN
AUSTRIA
NTH AUSTRIA
PESTH
EDLAND
LONDON
EDINBURGH
GLASGOW
DUNDEE
N. W.
WALES
S.
W.
E. W.
BELGIUM
BRUSSELS
LUTTICH
ANTWERP
BELGIUM
NETHERLANDS
HOLLAND
OVERYSSEL
AMSTERDAM
UTRECHT
SWITZERLAND
CH. WALLIS
" BERN
BERN
GENEVA
SWITZERLAND
PARIS
1865 TO 1881
1872 " 1877
LOMBARDY
LIGURIA
CALABRIA
VENICE
GENOA
ROME
ITALY
CATANIA
ALGIERS
AFRICA
67 HELENA
ALEXANDRIA
MELBOURNE
1868
AUSTRALIA
BOSTON
NEW YORK
PHILADELPHIA
NEW ORLEANS
SAN FRANCISCO
CHICAGO
SALT LAKE
PERNAMBUCO
RIO DE JANEIRO
MONTE VIDEO
AMERICA

variations of prevalence serve also to denote variations in the relative density of the population in different parts of the globe. In other words, in proportion to the number of the people aggregated together upon a given space of ground, so also is the rate of mortality from phthisis.

In Dr. Lombard's maps, the only portions of the earth's surface from which the color is entirely absent, are the arctic and sub-arctic regions, deserts, and high ranges of mountains, and it is precisely in those parts that human beings are fewest and most sparsely scattered over the ground.

In all the capitals of countries, and in the chief cities of Europe, Asia, Africa, and America, there is but little difference in the phthisis rate, and what differences there are are not to be accounted for by differences in climate. See Table II.

We are impelled to similar conclusions by a survey of the army and navy returns from all parts of the world.

We might then hastily conclude that but little of any value can be obtained from such a research as this, except that the very universality of the disease connects it with the collection together of human beings. And such a conclusion might, perhaps, have been reached by *a priori* reasoning. In the light of our present knowledge of the essential cause of phthisis, there is nothing surprising in our thus finding the disease wherever human beings are gathered together. So far as we know, the chief source of the organism that provokes the malady is the human race, and hence, unless there are adverse conditions, it might be expected to follow mankind in its distribution over the surface of the globe. Without further investigation then, it would appear as if the organism could exist under all conditions under which human beings could also live, and as if our search for secondary causes would lead to no definite or certain result. But this view would certainly be an erroneous one. It is already something to have ascertained that the disease may exist everywhere, under every sky, in country or in town, in all classes of society, in the palace and in the hovel, among the luxurious and well-fed, as well as among the poor and starving, but much more than this can be deduced from the statistics at our disposal. If we break up the figures presented to us into smaller groups—in other words, if we try to analyze the returns of the disease—we shall find out that it has its predilections; and by observing

GEOGRAPHICAL DISTRIBUTION OF PHTHISIS.
ARCTIC OCEAN
ARCTIC OCEAN
GREENLAND
NORTH AMERICA
ATLANTIC OCEAN
MADEIRA
EUROPE
ASIA
PACIFIC OCEAN
PACIFIC OCEAN
INDIAN OCEAN
AUSTRALIA
NEW ZEALAND

more narrowly its selection of favorite habitats and breeding-grounds, we shall obtain important indications that will guide us to a discovery of the conditions that determine its choice.

1. We have already some reason, in the almost universal presence of the malady, to conclude that the ancient doctrine of its origin in a damp, changeable climate is erroneous. It has been called "la maladie Anglaise," from its supposed excessive prevalence in this country; but we have already seen that it prevails to a still greater extent in the dry, sunny atmosphere of Egypt, as at Alexandria; and in the hot climate of South America, as at Pernambuco and Rio de Janeiro; but we may take another method of proving its independence of climate.

Let us take the extreme variations in the disease, in places geographically close together. We shall find that they are so great, and so frequent in different countries, that they could not have been due merely to differences of climate.

If we take the map of almost any country in the world and shade its several provinces so as to denote the varying prevalence of the disease, we shall discover not only that a great variety of tint has to be used, but also that the dark parts alternate with the light, without any reference to geographical position, north or south, east or west.

Thus, in Dr. Haviland's map of the distribution of phthisis in England and Wales, we find that dark blue and dark red spots, the antitheses of prevalence, are interspersed all over the map.

The same observation is true of Boudin's maps of France, showing the prevalence of chest-disease and scrofula. I have here also a map of Norway, displaying the same alternations of light and dark in all parts of the country.

But we may come to closer quarters still, and may take the variations within the areas of counties instead of countries; for instance, within the counties of England.

The following table shows some of these variations in different parts of England, and care has been taken to avoid the mention of places whose returns might be vitiated from the presence in them of large hospitals. There are only two exceptions to this rule, namely, Hastings in Sussex, and Liverpool in Lancashire. It will be noted that, in most of the counties represented, the difference between the highest and lowest

returns is more than 50 per cent, and in some the highest reading is more than three times that of the lowest.

TABLE III.—*Variations in the Consumption rate, at ages 15–55, per 100,000 living at those ages (Males).*

Counties.	Towns.	Highest.	Lowest.
Surrey	Guildford	526	—
	Farnham	—	242
Sussex	Hastings (H)	643	—
	Battle	—	180
Oxford	Headington	566[1]	—
	Banbury	—	241
Cambridge	Whittlesea	469	—
	Wisbeach	—	230
Norfolk	Walsingham	439	—
	Flegg	—	257
Wilts	Salisbury	438	—
	Mere	—	201
Cornwall	Redruth	461	—
	Launceston	—	223
Lincoln	Spilsby	361	—
	Caistor	—	205
Lancashire	Liverpool (H)	602	—
	Wigan	—	249
York	Reeth	589	—
	Settle	—	253

The same variation is to be found in other parts of the United Kingdom. Thus, in Scotland, consumption is almost unknown in the Western Hebrides, but, in towns on the west of the mainland, with a very similar climate and a similar race of people, it is very common. In Edinburgh, the rate per 1,000 deaths[30] is 102; in Glasgow, 371.

In Ireland, again, the rate of mortality from the disease per 100,000 of the population in the ten years, 1865–1874, was in the eastern division 259.62; in the western, 95.64.

Similar variations are to be observed in other parts of the world. Lombard gives the number of persons dying of consumption, per 1,000 deaths, in different places, as follows:

[1] Since this chapter was written I have been informed that the Radcliffe Infirmary, Oxford, is in Headington Union.

In Canada, the numbers vary from 241 in New Scotland to 138 in Quebec. In Russia, from 190 in Archangel, to 30 in Riga. In Holland, from 141 in La Dreuthe to 64 in Zealand. In Belgium, from 240 in Limbourg to 122 in Luxembourg. In Germany: Dresden 147, Weimar 74. In Italy: Milan 132, Turin 83. In Portugal: Lisbon 115, Malaga 54. In Egypt the general rate is 25, in Cairo 101. The variations cannot be due to climate, and probably arise from differences in the density of the population and in their mode of living.

But there is another mode of analysis possible. Perhaps the strongest proof of the existence of causes much more powerful than climate in producing a tendency to consumption, is to be found in the great differences between the male and female rates of mortality from the disease, in the same towns and districts. In the following table, I have selected from "Lowe's Tables" the male and female rates—(1) in places where the male rate exceeds the female rate, and (2) in places where the female rate is much the highest.

TABLE IV.—*Annual Average Proportion of Deaths from Consumption between the ages* 15 *and* 55 *per* 100,000 *persons living at those ages between the years* 1861–1870.

	Towns	Males	Females	Differences
(1.)	Cambridge	570	395	− 175
	Whitechapel	560	430	− 130
	Bath	540	355	− 185
	Greenwich	525	375	− 150
	Brighton	520	345	− 175
	Southampton	500	385	− 115
	Birmingham	475	345	− 130
	Newcastle	470	395	− 75
	Salisbury	440	305	− 135
(2.)	Sedbergh	365	615	+ 250
	Congleton	360	595	+ 225
	Bootle	225	555	+ 330
	Leek	355	525	+ 170
	Belper	275	455	+ 180
	Buckingham	275	455	+ 180
	Sevenoaks	290	455	+ 165
	Alston	285	425	+ 140

Towns	Males	Females	Differences
Camelford	230	295	+ 155
Battle	180	365	+ 185
Pickering	160	315	+ 155
Billesdon	120	265	+ 145

The differences between these figures, concerning two groups, male and female, of the population of the same places, constitute the main points of my argument at present, but I shall presently have occasion to return to them and attempt to draw from them the other lessons that they teach. The accompanying diagram shows graphically the differences between the male and female rates in towns and country places.

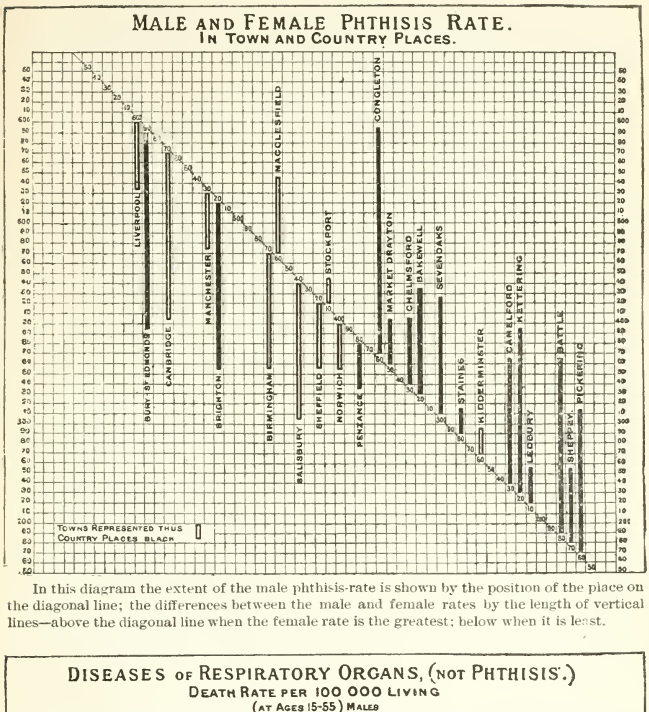
Enough has now been shown from the details of the statistics at our disposal, to prove that we cannot find in mere climate enough to account for the varying prevalence of consumption.

We have yet to consider the causes of the existence, upon the earth's surface, of cases of immunity from the disease. We have seen already that there are large tracts of country that are nearly, if not quite, free from the disease, and although this immunity may be due to sparseness of population, it is reasonable to ask whether an analysis of the figures may not bring to light some climatic or other conditions less favorable to the disease.

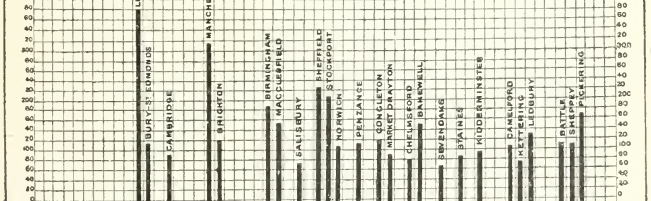
In Lombard's maps we have seen that there are certain broad spaces, untinted with color, showing regions still untainted by the disease. These spaces may be grouped broadly, under three heads:

1. Deserts, or sparsely populated places.
2. Mountain ranges or high plateaux.
3. Arctic, or subarctic regions.

It is not surprising to find that consumption is rare in the first of these groups. Where there are few human beings it is hardly likely that there will be much disease. But it is not merely the scarcity of possible victims that makes the disease uncommon, for the proportion of cases to the number of inhabitants in these districts is also very low, so far as we can judge from the imperfect data at our comand. Thus we are told by both Lombard and Hirsch that there is almost complete immunity from the disease in Nubia and Upper Egypt,



In this diagram the extent of the male phthisis-rate is shown by the position of the place on the diagonal line; the differences between the male and female rates by the length of vertical lines—above the diagonal line when the female rate is the greatest; below when it is least.



that it is very rare in Abyssinia and Central Africa; in the capital town of Oran, with 25,000 inhabitants, it is practically non-existent; and Livingston states that it is quite unknown in South Africa and in the interior of Cape Colony. It is rare in Asia Minor, Mesopotamia, Syria, Arabia, and Persia. In the steppes of Tartary, the interior of Australia, and in Tasmania it is almost unknown.

There are, however, certain considerations, apart from the wide separation of these districts from one another, that prevent us from ascribing this freedom from disease altogether to the climate. These spaces are often bordered by regions where the disease is much more frequent. Thus, in Asia Minor, it is often met with on the coast or in the principal towns. The Bedouins on the coast of the Red Sea, "who exchange their tents for stone-built houses," suffer from consumption.[31] In Syria, it is met with at Aleppo, and in the Soudan at Khartoum. In Zanzibar it is said to be especially common among Arabian women of the higher class—perhaps owing to their greater seclusion. While it is rare among the native Persians, who live an almost open-air life, it is more common among foreigners. In Algeria, while the nomad Arabs are free, "among the captives many die from the disease;" and in Egypt it is noted that while Syrians, Turks, Armenians, and Europeans seldom contract the complaint, Jews often become scrofulous, and die frequently of consumption. At Alexandria the mortality is nearly double that in England. In Australia it is almost as common in the large towns as it is in Europe. Again, we have to note the fact that in many parts of the world formerly almost free from the disease it is now rapidly increasing in prevalence. Information to this effect comes to us not only from Australia, but from Greece, Brazil, New Zealand, and the United States of America. Some observers state[32] that consumption is unknown in the western prairies of Illinois, Missouri, Iowa, Wisconsin, and Utah, and also in the Rocky Mountains; but, according to others, it has of late begun to show itself much more frequently, especially among the female immigrants. The climate has not changed, but the conditions under which life is carried on, especially the crowding together of the inhabitants, have altered, hence the increase of the disease. As Hirsch remarks,[33] "an altered mode of life among whole popu-

ations has had a most decided influence upon the rise and progress of consumption, while the climate in which they live remains the same as it was before.

Influence of Elevated Sites.

The second group of districts free from consumption, or nearly so, is of those parts of the earth elevated to a certain height above the level of the sea. In Lombard's map of the distribution of the disease, all the great mountain ranges are left blank: the Dovrefeld, the Ural Mountains, the Alps and Apennines, the sierras of Spain, the Carpathians, the Hartz, the Grampians in Scotland; in Asia, the high plateaux of Armenia and Persia, the Himalayas, and the mountain ranges of China; the table-lands of Abyssinia and of Mexico in North America, and the table-lands of Quito and of the Andes in the south continent. In all parts of the world, then, and in all climates, an elevated site seems to be, to some extent, a safeguard against consumption. The degree of elevation conferring this immunity was supposed by Gastaldi (who was one of the first to notice it) to be over 600 metres—about 2,000 feet—the disease being as common at points just under that height as on the plains. But in Western Texas, at a height of 2,100 feet, consumption is not uncommon; and the same observation has been made respecting the elevated plains of Castile and Leon, and of the Styrian highlands. It has been conjectured also that the freedom from the disease was due to the greater rarity of the atmosphere at these heights. (Dr. Marcet has recently carried on a series of observations upon the influence of altitude upon human respiration, which may throw some light upon the advantage of high levels in the treatment of phthisis (Proc. P. S., Vols. XXVII., XXVIII., XXIX., XXXI., and XLVI.). He proves that the volumes of air required to yield the oxygen necessary for the production of a given weight of carbonic acid, are smaller on mountains under diminished pressures, than in the plains under high pressures (the mean difference was 12 per cent); and he concludes that the respiratory function is therefore carried on more perfectly at these heights than in the plains.) But it must be remembered that the population of these elevated regions is much less dense than that of the lower ground, and

that the air in consequence is much less polluted with organic matter. Mountain and sea air are notoriously much freer from organisms than the air of plains, and Dr. Henry Bennet ascribes the beneficial influence of the climate of Mentone to the fact that the air breathed by the inhabitants must come either off the sea, or else over a range of mountains 4,000 feet in height. That the immunity is not simply due, however, to the rarity of the air is completely proved by Dr. Emil Müller, who, in his treatise on the "Distribution of Consumption in Switzerland," shows that there is no complete immunity from the disease in that Alpine country. A certain proportion of the inhabitants of these high places die of the disease, the rate depending, not upon the elevation of their dwellings above the sea, but upon the nature of their occupations. Industrial in-door pursuits give a rate varying from 6.5 to 10.2 per cent, and one of the highest of these rates (9.8) is at an elevation of 3,400 to 4,400 feet. At 4,400 to 5,000 feet, in mixed labor, the rate from the disease was 7.7 per cent. Here, then, we are obliged again to fall back upon the conditions of social life as a much more powerful factor than the influence of climate or locality.

Influence of Soil.

Closely allied to this point is the question of the influence of soil upon the disease. It has been shown by Dr. Bowditch in America, and by Dr. Buchanan in England, that places situated upon a damp impenetrable subsoil are much more subject to consumption than those placed upon a porous soil. Good drainage also has been found to diminish the prevalence of the disorder by as much as 50 per cent. These results have since been confirmed by Dr. Haviland, and by the Registrar-General of Scotland.

In the conclusions drawn from his map of the distribution of phthisis in England and Wales, Dr. Haviland says: "Damp, clayey soil, whether belonging to the wealden, oölitic, or cretaceous formation, is coincident with a high mortality;" and the Registrar-General, in his seventh report, remarks that "the towns, villages, hamlets, or houses which were situated at or near undrained localities, or were on heavy impermeable soils or on low-lying ground, and whose sites were consequently kept damp, had a very much larger number and pro-

portion of cases of consumption than towns, villages, hamlets, or houses which were situated on dry or rocky ground, or on porous light soils, where the redundant moisture easily escaped."

In an address to the Sanitary Congress, held at Leicester, in 1885, I gave the details of an inquiry I had myself made into this subject, that goes even further than those already cited—a contrast between two populations, one being on clay lands, the other on a hill of sand. The result was derived from a ten-years' mortality table, and was that, whereas in this period there had originated twenty-two cases per 1,000 inhabitants on the clay lands, on the sand only one per 1,000 had thus suffered, and that not one of the children or females of the population who were constantly resident there had contracted the disease. In this instance, however, we had not only the influence of a dry soil to deal with; the houses were those of well-to-do people, and were fairly well ventilated. Whether there would have been the same immunity under other conditions is very doubtful. Still it is evident that there is a close relationship between the condition of the soil and consumption, a relationship so close that, as we have seen, a residence on a porous soil, under otherwise favorable hygienic conditions, will apparently preserve the whole community from the disease.

It is further noticeable that in these cases hereditary predisposition makes no difference in the result. There were present in these populations many whose parents or near relations had died of the disease, and yet they did not contract it so long as they lived in the place.

And yet there is no necessary connection between dampness of soil and consumption. Dr. Buchanan's experience with respect to the influence of drainage of towns has not always been confirmed by other observers. (Dr. Kelly, M.O.H. for East Sussex, has shown that in 1861–70, the mortality of the several districts named by Dr. Buchanan had changed from that of 1851–60 without any difference of drainage.) Thus, "at Ashby-de-la-Zouch, the mortality from phthisis rose 19 per cent after the ground was drained." In Brunswick, according to Reck, "the mortality from consumption has not been greater in the wet parts of the town than in the quarters on a dry soil." "In Dantzic, where a system of main drainage

was carried out fully in 1871, the death-rate from phthisis, which had been (according to Lievin) 2.12 per 1,000 in the eight years preceding (1861–70), rose in the nine years following (1871–79) to 2.48 per 1,000." "At Berlin, in like manner, no notable effect on the prevalence of phthisis can be traced to drainage of the ground,"[34] and Hirsch says: "It seems to me to be a more probable explanation that other etiological factors, besides the influence of soil, come into the account under the given circumstances—factors that have a modifying effect upon the amount of the sickness, and serve to neutralize the benefits even of the most favorable conditions of soil."[35]

Moreover, there are, in different parts of the world, large tracts of country that are excessively damp, many of them indeed wholly given over to malaria and to intermittent fevers, and yet these districts are so free from the prevalence of consumption that some continental writers have supported the view that ague is antagonistic to phthisis. This theory has been conclusively proved to be erroneous,[36] but the different behavior of the disease in different districts would of itself be sufficient to show that the connection between dampness of soil and tubercular disease is not essential, and that the influence is one simply of predisposition, and favorable only to the development of the micro-organism when introduced by other means.

Influence of Cold.

The last group of districts, to a great extent exempt from consumption, consists of the arctic and subarctic countries of Greenland, Labrador, Iceland, Spitzbergen, Nova Zembla, Finland, Siberia, Canada, and the northern parts of the North American continent.

These are all cold countries, and it is owing to the geographical position of this group of districts, that we are unable to say that climate is wholly without influence upon the disease.

We do not know why extreme cold should be thus antagonistic to consumption, and the fact is entirely opposed to the notions of our forefathers on the subject. Not many years ago it was supposed that cold and exposure to the weather were among the most potent of the causes of consumption. Patients were sedulously guarded from every breath of cold

air in well-warmed rooms, or they were sent to warm, relaxing climates, such as those of Montpellier or Madeira.

We understand now somewhat better the operation of bright, dry, sunny atmospheres, and we know that their beneficial influence arises rather from their tempting the poor consumptive invalid into the open air, than from their freedom from cold.

It is now certain that not only is there comparatively little consumption in cold climates, but that many people predisposed to the disease, or actually consumptive, derive great benefit from a sojourn in the keen, dry, cold air of Canada, or from a winter spent amid snow and ice at Davos Platz or the Engadine.

But it is not yet clear in what way a cold climate exerts this favorable influence; we may indeed surmise that the lower amount of humidity in the atmosphere of these regions may have something to do with the results. Cold air has a much smaller capacity for aqueous vapor than warm air. It may thus be less capable of sustaining the life of the microscopic organisms that are the exciting cause of consumption; or again, it is possible that there are smaller quantities of organically-charged vapors arising from the ground, frozen as it is for so large a portion of the year. Moreover, in a frosty air the condensed moisture may entangle the organisms in its meshes, and may carry them down out of harm's way.

But all these suggestions are mere guesswork, and there are as yet no certain proofs as to the mode in which the tendency to consumption is lessened in these regions. Here again, also, we must notice the circumstance that all these countries are very sparsely populated, and that there is, therefore, comparatively little respiratory impurity constantly floating in the air. Moreover, just as it was found possible for men to override the beneficial influences of an elevated site, so, in cold climates also, they may live under conditions such as will lead to consumption as certainly as in less favored countries. Thus we are told by arctic voyagers, that the Esquimaux are not seldom affected by consumption, and the fact is hardly strange when we consider the mode in which they exclude all the air they can from their crowded huts. In Greenland, phthisis is one of the commonest causes of death, and similar reports come from New Archangel and

Alaska. In Canada also at one time the soldiers sent to that station died of consumption at three times the rate of the ordinary civil population in England in healthy districts.

The mortality from this disease among the troops in Canada, in the years 1830 to 1837 was no less than 23 per 1,000 of strength; and in healthy districts in England and Wales, at ages corresponding to those of the soldiers, the rate was only 7.7. In all England the rate was 9.2, and in Manchester, with all its unfavorable surroundings, it was 12.4, little more than half the military rate in Canada. The cause of this heavy mortality was discovered to be bad drainage, and want of proper ventilation of the barracks; and after these defects had been remedied, from 1863 to 1872 the rate was 9.49, and in 1874 it was only 6. These facts again point to other conditions of much more importance than that of climate alone.

2. We may next inquire statistically into the influence of malnutrition. It is not surprising that, at one time, tubercular disease should have been ascribed to some form or other of bad nutrition, and especially to a deficiency of fatty food. The poor ill-nourished denizens of towns have always furnished the largest proportion of victims of the malady. Thus it was found by M. Marc d'Espine that at Geneva, in every 1,000 deaths among the poor, 233 were from consumption, while of the rich, only 68 were from this disease.

And there are still medical men of eminence who ascribe to this cause the chief part in preparing the body for the reception of the bacillus.

Dr. Jaccoud, in his work on phthisis, affirms that the consumptive constitution is essentially due to "insufficient nutrition, taking this word in its widest sense."

M. Bouchardat also, in his treatise on hygiene, published in 1883, affirms emphatically that "the continuous loss of calorific elements, in any considerable proportion, leads to pulmonary tuberculosis" (p. 665). He defends this opinion by reference to the large mortality among cows, from tuberculosis, when the supply of milk is forced, and by the appearance of tuberculosis in the lungs of diabetic patients, when the elimination of sugar has taken place to any considerable extent for a sufficiently long period (p. 653).

He even ascribes the 68 deaths, in Marc d'Espine's tables

among the well-to-do, to some form of "Misère physiologique."

No one can doubt that want of sufficient food and mental distress are powerful agents in preparing the ground for the successful sowing of the seeds of consumption, but even if we had not known of the existence of a specific organism, and indeed before it was known, statistics were forthcoming to show that these causes are by no means essential to the production of the disease.

The terrible mortality from phthisis that prevailed at one time among the finest soldiers of the British army was certainly not brought on by starvation or misery. It occurred for the most part when they were not on active service, but in a time of peace, when they were well fed and well cared for so far as their bodily comfort was concerned—far better, in fact, than the half-starved workpeople and laborers, who only died of the disease at one-third the rate that they did.

3. Similar remarks, so far as the army and navy are concerned, would apply to the next series of supposed causes of consumption, namely, hardship, exposure to the weather, and cold. Nay! these conditions might rather be said to be antagonistic, than favorable to the onset of the disease.

The poor fishermen of Iceland, the hunters and trappers of North America, the nomad tribes of Asia and Africa, the wretched natives of Australia—all these people escape the disease almost entirely, while one-third of the deaths of the well-protected, well-clothed adult inhabitants of towns are from this cause.

The Highlanders, who inhabit well-built houses on the mainland of Scotland, are subject to the same fate as the other inhabitants; while the ill-fed, ill-clothed fishermen of St. Kilda and the Hebrides, who are of the same race, hardly ever contract the disease.

A striking case in point is quoted by Dr. H. Bennet from Professor Hind. "Consumption," he says, "is unknown among the natives of Labrador, while they remain in their own country. Here they live a kind of wild life, in tents made of spruce branches, imperfectly lined with skins, and more or less open on all sides to the air. They are exposed to famine and all kinds of hardship; but when they come down the great river, St. Lawrence, to take part in the fisheries, they occupy well-

built houses, and being well paid, they live in comparative luxury, and then in the course of a year or two become consumptive, and thus miserably perish."

We shall presently have to inquire into the question how far inflammations of the respiratory apparatus constitute a predisposing cause of consumption; but, whatever may be the outcome of that inquiry, it scarcely affects the present issue. It is very doubtful whether exposure to the elements, taken alone, is a common cause of these inflammatory attacks. We do not find that men who are much in the open air, and exposed to all vicissitudes of weather, are especially prone to catarrh or affections of the lungs. Soldiers on campaign, sailors, fishermen, hunters, gypsies, engine-drivers, coachmen, gardeners, agricultural laborers—none of these people suffer much from colds, unless they are intemperate. Arctic explorers confront the chilliest air that ever flowed. We are told also that Whymper slept safely "*sub divo*, in chill Alaska, with only a screen to windward, when the mercury in his barometer was frozen hard, and Von Wrangel relates quite a similar experience in respect of the dwellers by the shores of the Arctic Ocean." [37]

The experience of volunteers, who are generally men unaccustomed to open-air life, is to the same effect. On the other hand, we know that the inhabitants of towns not only contract diseases of the lungs, but die of their consequences in excessive numbers. It has been calculated that in Manchester people die of these complaints at more than three times the rate that people do in breezy Westmoreland. Mere exposure to cold and hardship and privation are not, therefore, to be reckoned among the causes of consumption.

But a closer inquiry into the figures laid before us gives not only negative but positive information as to the secondary causes of consumption, and we may safely draw the following conclusions from them :

1. That the occupations of a people have an important influence over the disease.

2. That its fatality increases with the herding together of populations.

It is probable that these two propositions have a good deal in common in respect to the causation of the disease, but it will be convenient to consider them separately and in detail.

1. *Influence of Occupation.*—There can be little doubt as to the indications given by our figures, respecting the injurious influence of certain occupations in predisposing to lung disease, and ultimately to consumption. The mere fact that in most countries where manufacturing processes are carried on the worst places are seen to be the manufacturing centres, would in itself be sufficient to arouse suspicion on this head. Thus, in England, the manufacturing counties of the north-west and west are the highest in the scale of mortality. In Dr. Haviland's map, if we leave out Wales, with its very doubtful statistics, we shall find the spots of darkest blue in the immediate neighborhood of the industrial centres in Lancashire, Cheshire, and Yorkshire.

In our own chart (see p. 198) the two highest columns of disease are those of Brunn in Moravia and Remscheid in Austria, and both of these are actively engaged in manufacture, the former of woollen goods, the latter of iron and steel. Nor are we left without direct testimony on this point. Drs. Headlam Greenhow and Arlidge in England, Finkelnburg and Schweig in Germany, Meynne in Belgium, Boudin and Chatin in France—all these observers concur in attributing a malefic influence to certain kinds of work.

In his report to the Privy Council in 1858, Dr. Headlam Greenhow pointed out the influence of occupation as a cause of pulmonary disease; and in 1860 and 1861 he followed it up by two admirable special reports upon the subject.

Without going into the minutiæ of these reports, it may be sufficient to summarize his conclusions, as to the conditions that render workpeople peculiarly liable to these diseases, by arranging them under the four principal heads:

1. The inhalation of dusts of various kinds.
2. Stooping postures at work.
3. Exposure to changes of temperature.
4. Bad ventilation.

But before considering his figures, it is important to observe that in his first report Dr. Greenhow grouped together all forms of disease of the respiratory organs—doubtless in order to avoid errors of diagnosis—and although in his later papers he gives the figures for phthisis and the other pulmonary diseases separately, it is significant of hesitation to accept the figures, that, in his final summing up at the end of each report,

he reverts to his former nomenclature, and speaks in general terms of "pulmonary disease."

In considering the etiology of phthisis we are bound to follow the example of this caution, and to decline to accept the figures placed before us as relating to tubercualr disease. It is also needful to attempt to distinguish between the direct effects of the occupation itself and those of the ordinary modes of life of the worker.

The subject further opens up wide pathological questions as to the modes in which the injuries sustained by the work-people lead to true tubercular disease. The discussion of this last-named point would, however, lead us away from the domain of statistics, with which we are now occupied, and it will therefore be best to reserve it for future consideration.

With these reservations we may turn to the conditions mentioned as causes of pulmonary disease:

1. *The Inhalation of Dusts of Various Kinds.*—Dr. Greenhow's statistics point to this occurrence as directly productive of pulmonary disease, including phthisis; but we can hardly admit into the latter category many of the cases included under this head in his figures—unless the word is so spoiled as to make it cover those of a non-tuberculous character.

It is certain that the kind of disorder at first produced is not true phthisis. In many cases—such, for instance, as "grinder's asthma"—the disease is at first one arising simply from mechanical irritation of the air-passages; and this irritation may lead on to emphysema, or to hardening and contraction of the lung tissues, and ultimately to their destruction, in a way difficult to distinguish from true consumption. In other cases the fine particles of dust of various kinds may even penetrate into the tissues of the lungs and to the bronchial glands, as was shown by Traube, Virchow, and Zenker, and experimentally by Von Ins, Sikorski, and others.

Various forms of these pneumono-konioses have been described, arising from particles of coal dust, steel filings, dust from stone, glass, or porcelain, and even from tobacco and cotton-flue. Doubt has been expressed as to whether most of these cases are not truly tuberculous (notably by Hilton Fagge), but those who have had much to do with such patients cannot share this opinion. I am quite sure that there

are many cases of true cirrhosis or fibroid disease of the lung, sometimes produced by irritating dusts, at others by pleuritic attacks often repeated, and ending in thickening and contraction of the interlobular septa, and, so to speak, in a strangling of certain portions of the lung. I have watched such cases for years, and have satisfied myself by repeated stainings that there were no bacilli in the sputum—and after death no signs of tubercle in the lungs. Such cases are, however, with difficulty distinguished from true phthisis. We must, therefore, look with some suspicion upon the tables laid before us; but, inasmuch as tubercle may undoubtedly be engrafted upon a lung injured by dust, it behooves us to inquire into the relative proportions of persons engaged in different trades, who are said to have died of phthisis.

The observation as to the injurious influence of dusts in this regard is by no means a new one. I need only note the elaborate works of Ramazzini and Thackrah on the subject.

Wepfer, in 1727, speaking of millstone-grinders, says: "Omnes phthisici fiunt."

Even if we assume that many workpeople commence with simple irritative diseases, we cannot refuse to recognize their trades as truly causes of consumption, if we find that large proportions of those who work at them ultimately fall victims to that malady.

All dusts, however, are not equally hurtful. The following lists, abridged from Hirt's tables, show how greatly the incidence of phthisis from this cause may vary.

TABLE V.—*Percentage of Phthisis in Total Numbers of Sick among Workmen Exposed to the Inhalation of Dusts of Various Kinds.*

Metallic.		Mineral.	
Needle-polishers	69.6	Flint-workers	80.0
File-cutters	62.2	Grindstone-makers	40.0
Lithographers	48.5	Stone-cutters	36.4
Grinders	40.4	Plasterers	19.0
Dyers	25.0	Porcelain-makers	16.0
Painters	24.5	Potters	14.7
Printers	21.6	Masons	12.9
Tinkers	14.1	Cement-makers	8.0

Vegetable.		Animal.	
Cigar-makers	36.9	Brush-makers	49.1
Weavers	25.0	Hair-workers	32.1
Millers	10.9	Turners	16.0
Bakers	7.0	Button-makers	15.0
Mixed.		**No dust.**	
Glass-cutters	35.0	Shoemakers	18
Glass-makers	17.8	Glovers	10.0
Day laborers	15.1	Butchers	7.0

It is evident from this list that the sharpest and most irritating dusts are those that tend most surely to produce lung disease, ending eventually in consumption.

The hardest and most pointed dusts, such as those from steel and flint, produce the most baneful effects, and after them come fine cuttings from bristles and the spiculæ of glass and porcelain. (This observation coincides with the results of Dr. B. W. Richardson's inquiry.) The dust of flour and the delicate fibres of cotton and wool do but little harm. This result is in accordance with our experience of the influence of the staple manufacture of my own neighborhood. In an inquiry as to the health of cotton operatives, Mr. Royston and I discovered that these workpeople are not more liable to consumption than the ordinary laborers of the town, the percentage of deaths from affections of the lungs being 61 for the former and 60 for the latter.[38] We came to the conclusion that "although these affections may be partly due to mechanical irritation from cotton-fibre and other substances arising from the work, they are still more frequently produced by the subtle diffusion of smoke in the atmosphere and the general vitiation of the air by noxious vapors and gases." Dr. Tracy, in Buck's "Hygiene," says: "It is doubtful if cases of phthisie cotonneuse occur at all in this country."

There are some differences between the arrangement of the trades in the order of their degrees of danger, as given by Hirt and by others; thus Eulenberg, in the "Handbuch der Gesundheitswesens," with regard to the mortality in Prague, gives the order of phthisis mortality as follows: Bookbinders, goldsmiths, glove-makers, stone-cutters, printers, turners, waiters, forgemen, locksmiths, bakers, joiners, potters, barbers, coopers, musicians, braziers, shoemakers, varnishers,

tailors, furriers, weavers, masons, butchers, brewers, tanners, mountaineers, gardeners, millers, room-decorators, ship-builders, coachmen.

The differences between the several sets of statistics are probably due to variations in the conditions under which the several classes of artisans did their work, but they add to our reluctance to receive the figures as evidence of the influence of the trades themselves, and make it probable that the conditions in question had at least as much to do with the result as the occupations.

In this regard, it is interesting to note that Seltmann [39] and Mirkel believe that the inhalation of carbon is antagonistic to the development of tubercle, and Mr. Simon [40] has called attention to the fact that the coal-miners of Durham and Northumberland are not especially liable to lung disease, and he accounts for this by pointing out the good ventilation of the mines in which these men work.

2. *Stooping and Constrained Postures during Work.*—The next great exciting cause of phthisis mentioned by Dr. Greenhow is the interference with the respiratory apparatus by posture, and he adduces as evidence the heavy mortality of the women and girls employed in the lace and hosiery finishing and winding looms at Nottingham, the watchmakers of Coventry, the hand-loom weavers of Macclesfield and Leek.

The following table, drawn from Dr. Greenhow's reports, shows how greatly the phthisis ratio of these artisans exceeds the standard:

TABLE VI.—*Death-rate per* 1,000 *Living from Pulmonary Affections.*

	Males.	Females.
Nottingham	8.13	7.03
Coventry	6.61	5.73
Macclesfield	7.43	8.51
Leek	7.80	8.51
Six northern standard districts	2.97	3.04

It is again difficult to separate the operation of this condition of work from other influences adverse to health, such as insufficient food and bad air.

Still it is evident that, from some cause or other, workpeople, who have to carry on their occupation in constrained

postures, do actually suffer more than others from consumption, and we shall presently see that modern research affords a reason why this result should probably follow.

On the other hand, it is only right to notice the observation of Rokitansky, Wagner, and others, and which has been generally confirmed by experience, that hunchbacks are but seldom affected by tubercular disease of the lungs. (I can myself only remember three such cases in my own practice.)

Moreover, the miners, whose exemption from phthisis has already been mentioned, work in the same cramped postures as their brethren in other coal fields.

3. *Exposure to Variations of Temperature, Moisture, etc.*—This includes the third class of conditions that, according to Dr. Greenhow, render workpeople peculiarly liable to pulmonary disease; and he especially instances the cases of slip-makers in potteries, and the spinners of flax, who are naturally exposed to heated and moist atmosphere, and the workpeople in overheated factory rooms.

There can be little doubt that these conditions, taken in connection with bad ventilation, have much to do with the prevalence of diseases of the respiratory organs; but, as we have already seen, they can only be very remotely implicated in the causation of phthisis, and I shall not therefore dwell further on this point. I have already shown that exposure to the weather alone is actually a preservative against both catarrhal affections and phthisis, and the statistics of occupations abundantly confirm this view. Engine-drivers and stokers on railways are certainly not specially liable to these disorders. Blacksmiths and charcoal-burners are peculiarly free from them. Forgemen, iron-puddlers, and glass-blowers also are not prone to contract consumption, though the last-named class are subject to emphysema.

The stokers on steamships must indeed be excluded from the category of persons thus free from a consumptive tendency; but another cause affects them, for their quarters are, for the most part, very contracted and badly ventilated.

4. *Working in Ill-ventilated Rooms.*—We have now reached the last of the conditions mentioned by Dr. Greenhow, as tending to the production of consumption among workpeople, and it is impossible to resist the conclusion that it is the most powerful of them all. Most, if not all, of the condi-

tions that we have found to lead to consumption have had associated with them air rendered impure by breathing, and allowed to stagnate through want of proper ventilation. The dusty atmosphere in workshops is also often a confined atmosphere; the persons who work in a constrained or stooping posture do so for the most part in crowded, ill-ventilated shops or workrooms, or in the recesses of mining galleries; and the effects of variations of temperature in factories are aggravated by the same cause. But there is plenty of direct evidence on the point. Dr. Greenhow's inquiry, in 1860, led him to the conclusion that "in proportion as the male and female populations are severally attracted to in-door branches of industry, in such proportion, other things being equal, are their respective death-rates by lung disease increased."

He instances especially as occupations injurious in this regard: 1. The making of earthenware and china, as at Stoke-on-Trent and Wolstanton. 2. Tin and copper mining (Penzance and Redruth). 3. Lead-mining (Reeth). 4. Flax factories (Pateley Bridge). 5. Silk-working (Macclesfield and Leek). 6. Wool factories (Leeds, Bradford, etc.). 7. The making of hosiery (Leicester and Hinckley). 8. Cotton factories (Preston). 9. Lace-making (Towcester and Newport-Pagnel). 10. Straw-plaiting (Berkhampstead). 11. Glove-making (Yeovil). This is a long list, and it already contains several of the trades whose tendency to phthisis had been set down mainly to other causes, notably the potters of Stoke-on-Trent, whose illness had been ascribed to dust; the silk-workers of Macclesfield and Leek, who were supposed to have suffered from stooping during their work; and the spinners of flax, who are also exposed to variations of temperature; but, in truth, Dr. Greenhow's reports abound in notices of the bad ventilation of all kinds of workrooms, and instances of the good effect of ample cubic space and of free currents of air.

Thus he mentions the intolerance of ventilation shown by mould-makers at Stoke,[41] the bad ventilation of flax factories at Pateley Bridge (p. 149); the overcrowding and want of ventilation of living-rooms and factories at Macclesfield and Leek (p. 155). In one of the latter the space was less than 200 cubic feet per head, and of ventilation there was none.

But, perhaps, the most striking proof of the influence of confined air, in the production of consumption, is to be found

in the relative death-rates from this disease among males and females respectively, which have already been given. (See Table IV. and Diagram, p. 205.) The greatest range of difference in these rates is found in the agricultural districts, where the men are mostly employed out-of-doors, and are but slightly affected, while the women are employed at home, and die of consumption at twice the rate of the men. I would especially instance Battle, Pickering, and Billesden. It will further be found that in manufacturing towns, the incidence of phthisis is heaviest upon that sex which has most to do with in-door employment.

On the whole, as Mr. Simon says,[42] in his summing up of the evidence, "among the aggravating circumstances that may indefinitely increase this evil [lung disease], probably none is so effective as the bad ventilation of the work-place."

"The concurrent testimony of these most various illustrations is that, commonly, where many persons are employed together at any in-door industry, the ventilation of the work-place is likely to be so bad as to convert the employment, which perhaps is not in its own nature of hurtful tendency, into an employment seriously dangerous to health. Here lies the explanation of a fact most deplorable for the working classes of our country—that, in proportion as the people of a district are attracted to any collective in-door occupation, in such proportion, other things being equal, the district death-rate by lung diseases will be increased. For the bad ventilation, which, as a rule, belongs to the place of employment, tends to develop among the workpeople a large excess of phthisis, and probably also some excess of other fatal lung disease."

5. *Air Rendered Impure by Respiration.*—We are thus led inevitably, by the statistics, to the reason for Dr. Greenhow's second proposition, that the fatality of lung disease increases with the herding together of populations in large towns, and this is, that the truly infective impurity of the air must be in some sense a respiratory impurity. We have already seen that the specific organism of tubercle has been discovered in the air of consumption hospital wards—in the dried-up sputa of phthisical patients, and even, though rarely, in the aqueous vapor exhaled from their lungs. It was therefore certain that the disease must be mainly derived from this

source; but we now see, from the concurrent testimony of facts, drawn from the geographical distribution of the disease, and from the rates of mortality from lung disease among workpeople, that the power for evil of the disease-germ increases, *pari passu*, with increase in the density of the poison.

Baudelocque, in his treatise on scrofulous disease, was perhaps the first clearly to see that this was so. Speaking of air rendered foul by breathing, he says: "This is the true cause—perhaps the sole cause—of the disease of scrofula," and he adduces many proofs in support of his theory.

Sir James Clarke also, in 1835, in his monograph upon consumption, speaks of "the respiration of a deteriorated atmosphere as one of the most powerful causes of the disease." (But the truth was hardly fully accepted until Dr. McCormac took up the subject, and with iteration insisted that, "wherever there is foul air, unrenewed air, impure air . . . there we meet consumption, there we meet scrofula and an untimely death.")

In one of his early letters to the Registrar-General, Dr. Farr gave some statistical evidence to show that the mortality from diseases of the respiratory organs and from phthisis is in direct ratio to the density of population. The following table is drawn from the annual report:

TABLE VII.—*Mean Mortality in three groups of the Thirty-two Metropolitan Districts*, 1839.

Districts	Square yards to one person	Annual rate per 100,000		
		Totals	Respiratory organs	Phthisis
1 to 10	57	3321	822	478
11 " 20	78	2839	768	451
21 " 30	217	2169	588	354

The table (p. 173) showing the mortality in different parts of the world, drawn up for the Army Sanitary Commission, bears witness to the same facts; and the commissioners, in their report, point out that "in civil life, insufficient clothing, insufficient and unwholesome food, sedentary and unwholesome occupations, and the vitiated atmosphere of unhealthy dwellings, all contribute to the propagation of this class of diseases. But in the army it cannot be alleged that the clothing, the food, or the nature of the occupation in itself are of a character

which would justify the imputation that they are among the predisposing causes of the excessive mortality of the soldier by pulmonary disease.

"The ravages committed in the ranks of the army by pulmonary disease are to be traced in a great degree to the vitiated atmosphere generated by overcrowding and deficient ventilation, and the absence of proper sewerage of barracks."

In reference to this, Dr. Farr said: "The prevalence of phthisis in the armies of Europe is probably due in part to the inhalation of expectorated tubercular matter, dried, broken up into dust, and floating in the air of close barracks," and Dr. Parkes remarks that this prevalence "can scarcely be accounted for in any other way than by supposing the vitiated air of the barrack-room to be chiefly at fault." Mr. Welch, of the Army Medical School, Netley, also proves that consumption in the army increases with length of service, and that it is due in the first place to "vitiated barrack atmosphere," and to constant irritation of foul air inspiration . . . the chief deleterious agent in the generation of consumption being the organic matter, which, taken into the air-passages, there lodges, and chronically irritates." [13]

Dr. Parkes, in his work on hygiene, gives numerous instances of the influence of re-breathed air in the production of phthisis—instances drawn from the history of prisons, jails, and workhouses; and Hirsch, in his articles on scrofula,[41] and on consumption,[15] gives long lists of examples of the origin of both diseases under circumstances in which confined air must have been the principal factor.

But we have still not quite reached the limit of the aid to our inquiry that may be obtained from statistics of disease. We may push our investigation into still closer quarters, and, abandoning total death-rates of institutions and towns, we may examine into the mortality of certain districts, and even of certain houses.

In a paper on "Tubercular Infective Areas," read two years ago before the Epidemiological Society, I gave the details of an inquiry made into the incidence of phthisis in some of the worst districts of Manchester and Salford—an inquiry that was greatly facilitated by the kindness of the medical officers of health of these boroughs, and by the excellence of the mortality tables which they placed at my disposal. Its

results showed that the portions of these districts most affected by the disease were the close courts and alleys, the shut-in or blocked-up lanes, and, above all, the houses built back to back with no thorough ventilation. I especially noted the cases in which, in the space of five or six years included in the inquiry, double or treble occurrence of the disease had taken place in the same houses, and I found them very numerous.

These results have been confirmed by other observers. Thus Dr. Niven, of Oldham, writes to me respecting 3,001 deaths from tuberculosis, which occurred in that town during eleven years (1877 to 1887), and states that they took place in the worst class of houses, and in 302 cases there were two or more in a house. He has calculated mathematically the chance of any one house being twice affected (not infectively), and he finds that only sixty-eight, on this hypothesis, would have thus suffered, whereas 274 houses were so attacked, and that while not more than 7.6 houses should have suffered thrice, the actual number so attacked was 24.

In a joint report to the local government board, made in 1888, by Dr. Barry and Mr. P. Gordon Smith, on "Back-to-Back Houses," which included several of the districts which I had selected, the conclusion formed upon this point is, "that it appears probable that the want of through ventilation . . . gives rise to an increased mortality from pulmonary disease, phthisis, and diarrhœa."

Again, Dr. Flick, of Philadelphia, has recently carried out an elaborate topographic study of phthisis in that city, extending over a period of twenty-five years, and he draws the following conclusions: (1) "that a house which has had one case of consumption will probably have another within a few years, and may have a very large number of cases in close succession;" (2) "that when a case of consumption occurs in a house, approximate houses are considerably exposed to contagion;" (3) "that houses in localities where endemic after endemic has existed, have nevertheless escaped the disease;" (4) "that tuberculoses of different kinds occur in the same localities, and often on the same lots as consumption," and (5) "that during the twenty-five years scarcely 20 per cent of the houses of the ward were so affected."

He ascribes these results to contagion in the houses themselves.

These facts must be placed in apposition with Dr. Cornet's researches upon the bacillus-holding properties of the walls of houses in which consumptive patients have resided. They may probably afford an explanation of many of the facts detailed in the course of this chapter.

In the next chapter I will return to the subject of contagion.

CHAPTER III.

PREDISPOSING CAUSES OF PHTHISIS.

The considerations and the evidence adduced in the preceding chapters may perhaps be sufficient to show the part that is played by the bacillus of tubercle in the production of the lesions of phthisis, and to indicate the chief circumstances that influence its general distribution among groups of mankind.

We shall now have to consider both the conditions that render individuals liable to contract the disease, and some of the modes in which the parasite gains an entrance into the body.

We have already seen that the disease may be found everywhere that men are congregated together, or, as it might perhaps be more correctly stated, everywhere that tuberculous individuals are, or have been, present within a recent period. Nor is it difficult to understand why this should be so, in the light of modern research. It has been calculated by Bollinger that one phthisical person may eject from his body in the course of twenty-four hours no fewer than twenty millions of bacilli. Moreover, for the greater part of their illness, consumptives are not confined to their rooms or to their houses. They go about like other people, and mix in crowded assemblies, discharging their bacillus-laden expectoration in every convenient place. The sputum thus ejected has been found by Koch to possess a marvellous tenacity of life, being still virulent in the dried-up sputum after a lapse of several months.

The walls of houses, and the dust that flies about in the air, have been shown by Cornet to contain the virus in an active condition.[46]

It is certain, therefore, that the germs of the disease are almost everywhere present, and that all of us inhale some of them in the course of each day or week.

It would seem also at first sight that, once received within the body, the bacillus would have no difficulty in obtaining nourishment and in growing. Professor Koch's observations show that the bacillus requires only a certain amount of moisture, a temperature of between 82° and 107° Fahr., and a supply of nitrogenous food, such as blood-serum—all of which conditions are to be found within the human body. The presence of phthisis in our midst ought not then to be difficult of explanation; we should rather, in the first place, seek out the reasons for the exemption of so many from the results of infection.

Reasons for Immunity from Tuberculosis.

Among the conditions necessary for the growth of the bacillus, there is yet one that was mentioned in the chapter, and which is of great significance, namely, that it requires a sojourn of one or two weeks, and sometimes more, in a suitable medium before it can take root, so to speak, and develop into a colony.

Now from Watson Cheyne and Dr. Kidd and others, we learn that the epithelium of the ultimate portions of the air-passages is usually the first point of attack by the organism. We may therefore suppose that it is necessary for the organism to effect a lodgment somewhere in this position.

Or again, it may perhaps make its way into the inter-alveolar lymphatics by means of the prolongations of the branched cells of the alveolar septa, called by Dr. Klein "pseudostomata," which he has shown to be capable of taking up foreign bodies, such as oxide of iron, silica, and even carmine (Sikorski).

It can hardly be doubted that, if these inorganic particles can thus find an entrance, the bacillus of tubercle may do the same, and thus the way into the body might be supposed to be opened to the organism; and, once planted in such soil, if it can remain there a sufficient length of time, it will find a suitable temperature and ample supplies of the nourishment that it requires; but there are in the healthy body various impediments, mechanical and physiological, which it is difficult for it to over-pass, and which will probably account for the immunity of all those in whom these barriers have not been previously broken down.

1. We have the difficulty with which minute bodies such as the bacilli could reach the ultimate air-passages.

It is true, as Professor Tyndall has shown by means of his illuminated tube, that the lungs possess a sort of filtering action, catching up the organic dust inhaled with the air, and preventing it from coming forth again with the returning breath, but this action is due to the entangling of the dust by the mucus lining the air-passages. Before it has reached the ultimate ramifications of these tubes it is caught on the glairy mucus, and is speedily ejected by the action of the ciliary waves.

That this filtering action is not complete, however, I have myself proved, both by the microscopical examination of the aqueous vapor of the breath, in which there were numerous epithelial scales and other objects, and by the detection of a few, very sparsely scattered, bacilli in the breath of certain consumptive patients.

In some forms of lung-disease, also accompanied by copious bronchial secretion, the probability of this event is increased, especially if the accompanying cough prevents the lodgment of mucus in any of the air tubes. As has been shown in the research just mentioned, the organic matter of the breath is always less when there is much secretion. The proportionate amount of this substance exhaled in the aqueous vapor from the lungs, was only one-half of that from healthy persons, not that there is really less organic matter thus excreted, but because it was taken up by the mucus before it could reach the mouth. The immunity from phthisis of many cases of chronic bronchitis and emphysema is, perhaps, due to this cause. On the other hand, the influence of a lessened mobility of the chest, and the consequent partial stagnation of the air, is shown in the tendency of the upper lobes of the lungs to tubercular deposit, and we may place in the same order of predisposing causes, the evil results of stooping or constrained postures during work. Perhaps, too, the well-known tendency to tubercular infiltration of parts of the lung confined by pleuritic adhesions, or consolidated by catarrhal pneumonia, may be due to the facility afforded for a prolonged lodgment of the bacillus, and the same may be said of hemorrhagic deposits in the lungs. In this case the organism would receive both board and lodging for a term sufficient, in many cases, for its development.

2. Another barrier to infection from the bacillus, even if it obtains a temporary lodgment, may be found in the vital processes carried on in the lungs. I am not aware of any direct experiments upon the action of nascent oxygen, or of ozone, upon the virulence of the bacillus; but my own experiments with the latter agent in fifteen cases of phthisis seem to show that it has a distinct influence in enabling the system to tolerate the presence of these organisms, and gain health and strength in spite of their continuance in the body. Moreover, the abundant records of the good effects of open-air life, and of free ventilation, seem to show that the disease cannot gain ground under these conditions. It seems highly probable that the bacillus of tubercle, though it may not be destroyed at once by these agents, yet is robbed of its power for evil by the same processes that Dr. Angus Smith and Pasteur have proved to take place in certain other organized ferments.

In any case, whether by simple oxidation, or by the energy of other vital actions—probably also, as Koch and others have shown, by the direct antagonism of phagocyte corpuscles —it is certain that the healthy human body has the power of disposing of a certain quantity of these creatures, even after they have been directly injected into the system.

3. There remains the question of dosage. Many of the facts ascertained, with regard to the spread of ordinary epidemic infectious diseases, seem to show that a certain concentration of the virus is necessary, before they can overcome the resistance opposed to them by the bulk of the population. The definite cyclical periods, observed by many of these disorders, render it highly probable that a certain density of the susceptible population must be attained before they can spread through large communities ("Epidemic Cycles," Proc. of Lit. and Phil. Society, Manchester).

The recent observations of Bollinger on this point, with reference to tubercle,[47] are of great interest.

He shows that very dilute solutions of sputum (1 in 100,000) and of cultures of bacilli (1 in 400,000) are virulent when injected into the peritoneum, but that much lesser dilutions were inoperative upon the intestine. In these researches the peritoneum remained sound in two-thirds of the cases, but the disease attacked the lymph-glands, the spleen, and the lungs. Incidentally it may be remarked that this observation shows

that lung-tuberculosis need not always depend upon inhalation, but may arise from virus that has been swallowed or injected.

But in addition to these evidences of varying susceptibility to the poison, Dr. Bollinger ascertained that while 800 bacilli, when injected into the peritoneum, are sufficient to cause the disease, smaller numbers than these become less and less certain in their operation.

We may gather from these facts the lesson, that up to a certain point the healthy body is able to destroy, or at least render innocuous, the organisms that gain access into its interior. There are probably great differences in this respect in different individuals, just as we know that some people seem to be quite proof against the infection of certain exanthemata, while they are especially prone to others.

It is worth noting that certain diseases, such as mitral stenosis and gout or lithiasis, are supposed to confer an immunity to the disease, but the explanation of this phenomenon is not yet clear. (Verneuil has only found two cases of phthisis associated with stone in the bladder, and finds upon inquiry that it is altogether exceptional ["Études," I., 229]. E. Solles ["Études," II., 95] regards erysipelas as also antagonistic.) The workers in copper are said to be more exempt than other people from phthisis, and Sir J. Simpson thought that the woollen manufacture conferred a certain degree of immunity upon the mill-hands of Yorkshire. These are some of the reasons for immunity.

Reasons for Infection.

It behooves us next to inquire whether there are any characteristics that make men unusually liable to contract tubercular disease.

It has long been assumed that there is a scrofulous diathesis or tuberculous constitution, and in 1860 Sir W. Jenner gave his classical description of the contrast between these two types of temperament. Since Galen also it has been supposed, that a peculiar form of configuration of the chest predisposed persons to contract the disease, a supposition advocated by Traube in Germany and by Dr. Gee in England.

I do not know how far these views are accepted at the pres-

ent day. It seems highly probable that a certain form of chest, with insufficient expansive and expulsive power, may afford opportunities for the deposit of the tubercle bacillus. But, on the other hand, I have seen men of the finest physique, and with magnificently-developed chests, fall victims to the disease. I apprehend that many of the cases recurring among Her Majesty's foot guards must have been of this description.

I. Hereditary Tendencies.

Few medical men who have been long in practice will doubt the existence of family predisposition to tubercular disease. Thus most of us have seen instances of families in which almost every member has died of the disease, and others in which members of the same family, living in different and sometimes far-distant places, have yet most of them ultimately succumbed to it. Yet it is quite possible to make too much of this influence.

When we consult the statistics that have been put together on the subject, we find great differences in the results given by different observers.

Thus Briquet found that one-third of the consumptive patients at a hospital were born of consumptive parents on one side or the other; Dr. Quain, 25 per cent; Dr. J. Pollock, 30 per cent; Dr. C. T. Williams, 12 per cent of direct influence, and 48 per cent of family predisposition. Rilliet and Barthez found that one in seven of tuberculous children had some hereditary taint; Mr. Phillips only 4 per cent, Lebert three-fifths. Lugol states that more than half the subjects of scrofula have consumptive progenitors. Francis Galton [48] gives 26 per cent of consumptive children by one method of calculation, and 28 by another. But in these figures no account is taken of the influence of external circumstances—sources of infection from without that are common to all the members of the family.

Again, there are so many deaths from phthisis in the country—nearly half of all the deaths between the marriageable ages, from fifteen to thirty-five, are due to this cause—and hence without any such thing as hereditary taint, there would be nothing surprising in the fact that half of the consumptive patients have had consumptive relatives, unless the

families were unusually large, and if we draw grandparents and collateral relatives into the statistical net, it breaks at once and holds no solid conclusion.

Dr. Walshe (the chief authority on chest diseases in this country) obtained from his hospital patients the result that about 26 per cent came of father or mother, or of both parents similarly diseased; but in discussing the significance of these figures, he asks whether they prove the reality of hereditary influence, and decides that they do not. "This ratio," he says, "of 26 per cent might be, and probably is, no higher than that of the tuberculized portion of the population generally," and he concludes that "much phthisis is, in each generation, non-hereditary."

It is, moreover, highly probable that heredity has much less to do with consumption than is commonly supposed. A very large proportion of cases arise without any phthisical family history of the past. Many healthy families leaving the country and coming to reside in crowded towns, lose some members subsequently from consumption. In the army more than 60 per cent of cases are non-hereditary.

It will thus be seen that, although we cannot say with Louis,[49] "Nous n'avons recueilli aucun fait en faveur de l'hérédité de la phthisie," yet we must ascribe to it a much smaller influence than is usually given.

Granting also the real influence of heredity in predisposing to tubercle, there are at least three distinct modes in which it may be exerted. 1. By the direct infection of a child with the disease in an active state. 2. By the implantation of the organism or of its spores, which may remain for a period latent in the system. 3. By the transmission of a constitution peculiarly open to attack by the bacillus—in other words, an undue vulnerability of the system.

It is possible that each of these circumstances may occur. 1. We occasionally see cases of undoubted congenital tuberculosis, and the researches of Landouzy and Martin, of Lannelongue and of Niepce,[50] show clearly the possibility of this event.

The first-named authors show (pp. 59–74) the tuberculizing power of the seminal fluid of tuberculous Guinea-pigs. Niepce found bacilli in the semen of tuberculous individuals, and Lannelongue declares in favor of the doctrine of intra-uterine infec-

tion of the fœtus (p. 97), citing in support the aforesaid researches, and the observations of Demme, who found in two infants, one of whom died on the twenty-first day after birth, an intestinal tuberculosis, and the other at the twenty-ninth day, a pulmonary tuberculosis with an advanced cavity in the lung. He opposes these facts to the assertions of Leudet, who had never seen a case of fœtal or congenital tuberculosis, whether hereditary or acquired; of Vallin, who speaks of it as so rare as not to be worth notice; and of Professor Peters, who declares roundly that "on ne naît pas tuberculeux mais tuberculizable" (p. 94). Bollinger[51] says: "Die sogenannte congenitale Tuberculose so gut wie auszuschliessen ist." (An interesting fact in relation to this point is given by M. Duprey, that in a flock of merinos, a phthisical ram produced from sixteen to twenty tuberculous sheep.—"Traité de l'Affection Tuberculeuse chez les Animaux," Paris, 1817.)

2. Lannelongue ascribes the rarity of early tuberculous infection to the conditions of resistance in the bodies of infants and children, which may have the power of keeping the virus in a latent state, and which may even prevent its development altogether.

Baumgarten[52] goes much farther than this, and boldly says that "tuberculosis may remain latent, under certain circumstances, during the whole of life, without interfering with living functions in any observable degree." Nay more, he believes that it may pass through a generation and be transferred from grandparents to grandchildren. He places it in the same category with syphilis and leprosy, and ascribes the greater part of the tuberculosis in the world to this hereditary descent.

He defends this thesis by an appeal to the experiments already quoted by Landouzy and Martin, Queyrat and Lannelongue,[53] and cites in its favor not only his own researches, but those of Marchand,[54] of Bollinger (Gosselin, "Études sur la Tuberculose," Verneuil, p. 34, also gives instances in which iodoform seemed to render sterile the thousands of bacilli injected into rabbits; but he remarks that it seems impossible that they can remain inactive for several months and then revive), and other pathologists, though, as we have seen, Bollinger is certainly not on his side. He also endeavors to show the inadequacy of other explanations, such as infection by the air, by food, etc.

But, with all respect to so able a pathologist, I must say that Professor Baumgarten has failed to convince me of the truth of his theory.

There is no direct proof that the virulence of the bacillus can remain latent for more than a few months. The heredity of leprosy is still unproved, and even if the evidence in its favor were stronger, the nature of the hereditary tendency to contract it is as uncertain as is that to tuberculosis.

The analogy of syphilis with tuberculosis is also not yet made out, and the character of its latency is still *sub judice*. Dr. Baumgarten also surely underestimates the great weight of the evidence that connects phthisis with the inhalation of impure air, and with in-door occupations. On these grounds, therefore, we certainly ought to hesitate before accepting the fatalistic doctrine of the inevitable nature of inherited tuberculosis.

3. The last-named form of hereditary influence is probably the most common.

We know that a tendency to contract other diseases than phthisis is not infrequently transmitted from parents to children. Our own royal family have shown a peculiar proclivity to both typhoid fever and diphtheria, and a similar predisposition to contract these diseases occurs in other families. I know, for instance, of one family in which six out of eleven children have died of diphtheria, and other members of the family have suffered from, but have survived, this complaint. They were not all of them struck down at the same time, or by the same epidemic; but three children died in South America, one in the South of England, and two in the place where they are now residing. Such a fatality as this from a particular disease displays a strong family predisposition both to contract the disease and to succumb to its attack.

Much the same must be said of a hereditary tendency to consumption; but there is no more need to assume the existence of a tubercular constitution than of a diphtheritic or typhoid diathesis.

Villemin distinctly repels the idea of the existence of such a constitution, and says of heredity that "the sole influence it exerts is in the transmission of an aptitude to contract the disease."

Niemeyer says: "I do not hesitate to say, in spite of all

assertions to the contrary, that it is by no means proved that tuberculosis, in the strictest sense, is an inheritable disease;"[55] and again: "Quite as decidedly as we have opposed the evidence that tuberculosis is inheritable, must we pronounce in favor of a frequent occurrence of an inherited disposition to pulmonary phthisis" (p. 20).

I admit the existence of hereditary predisposition to tubercle, but I do not attribute to it a great importance; and, if we set aside the few congenital cases of the disease, I believe that the transmission of an aptitude to contract it, does not necessarily lead to the disease itself—if care is taken to avoid the sources of external infection. In short, I am inclined to agree with Louis when he declares that "few persons are born necessarily to die of consumption."

II. Age, Sex, and Race.

Somewhat similar remarks must be made with respect to the influence of age, sex, and race upon the tendency to contract the disease. We have already seen that, up to the age of puberty, the mortality from phthisis is comparatively small; but after this age the younger residents in an infected house are always the first to succumb to the disease.

This fact comes out in many of the returns obtained by the Collective Investigation Committee of the British Medical Association. In several of the cases of the almost wholesale destruction of a family residing in one house, the older members, the father and mother, escape the disease.

Sex seems to have only slight influence—it is at any rate as nothing against the overpowering presence of such circumstances as in-door employment, unhealthy trades, etc.

All races also, as we have seen, suffer more or less from the disease, though it is acknowledged that the negro, as well as the monkey, suffers grievously when transplanted from his own land. (It must be pointed out, however, that in most cases he is lodged amid most unhealthy conditions when he is thus brought over.)

III. The Influence of Previous Diseases, either General Diseases of the Body or Local Diseases of the Lungs Themselves.

It is well known that certain disorders, such as enteric fever and measles and small-pox, especially after an imperfect recovery, often leave behind them a serious tendency to tubercular disease. This tendency may be due simply to their debilitating influence, or more frequently to the fact that by reason of the lesions of surface that have taken place in the course of these diseases, a portal has been opened through which the bacillus of tubercle can enter.

Over-lactation, frequent pregnancies, diabetes, and other debilitating disorders are probably predisposing causes, as rendering the system less able to destroy the organisms that accidentally make their way into the system. But it is to previous affections of the lungs that we must look as the most common causes of bodily predisposition.

Most phthisical subjects refer the onset of their disease to a "chill," or to a "neglected cold," and some observers, such as Dittrich, Niemeyer, and Buhl, went so far as to ascribe nearly all cases of tuberculosis to "catarrhal pneumonia," a disease which was supposed to be the main source of the caseating masses found in phthisical lungs after death. In this opinion they were followed by many other pathologists. Recent researches have, indeed, proved the erroneous nature of these conclusions, and have established Laennec's doctrine that these masses are themselves truly the result of tuberculosis, but they have not affected the observation that many cases of phthisis are preceded by purely inflammatory diseases of the lungs, such as pleurisy, acute bronchitis, broncho-pneumonia, and imperfect resolution of ordinary pneumonic inflammation. ("In my experience croupous pneumonia is the commonest form which produces a fibroid change. The unabsorbed residue sets up an irritation, which is followed by increase of the normal fibrous tissue until large bands of this are seen in parts of the lungs; the process is a very chronic one, and is generally associated with much pigmentation and anthracosis. In these cases—at any rate in some of them—the consolidated material after a time

caseates and breaks down, and in this can be found the tubercle bacilli. I have noticed one peculiarity in connection with this disease, that is the formation of large giant cells at the edges of the consolidation, together with fibroid tissue resembling tubercles. This was of quite recent date and probably corresponded to the breaking down of the consolidation. In miner's and other kinds of phthisis, caused by long-continued irritation, the process is essentially the same; it results in the formation of dense fibrous tissue. The breaking down in these cases seems to be independent of the original disease." Gibbes and Shurley, "Etiology of Phthisis," "American Jour. of Med. Science," March, 1890.)

It is not difficult to understand why these diseases should prepare the way for the entrance of the tubercular virus. We have seen the nature of the safeguards against infection that exist in healthy lungs; but in acute bronchitis one of the earliest changes is the detachment of the ciliated epithelium of the affected bronchi, and this remains absent during the course of the disease. It is true that there is also, usually, an abundant proliferation of epithelium and of mucous fluid from the mucous glands, and that this may, and generally does, arrest the progress of infection; but any germs that escape this trap will probably find their further progress facilitated by these changes. Koch ascribes the tuberculosis following measles to this source.

Even in chronic bronchitis, after a time, the expulsive machinery may become defective, the waving cilia may become less active, the muscular apparatus of the tubes may be weakened, and dilatation and plugging of the air-passages may occur; thus the bacillus may find a lodgment within the lungs, and true tubercular disease may be set up. This specific infection is again still more likely to take place if, from any cause, the ultimate tissues become inflamed, as in the various forms of catarrhal pneumonia or broncho-pneumonia. The lung loses its elasticity, its tissues are more open to infection, the residual air becomes stagnant, and its impurities, including foreign germs, are liable to be imprisoned for an indefinite time.

But that there is no necessary connection between ordinary diseases of the respiratory organs and phthisis may be shown by comparing the rates of mortality of these two

classes of disease. I have here a chart (see p. 205), drawn from Lowe's tables, from male populations at identically the same ages (*i.e.*, from fifteen to fifty-five), from which it may be seen that the height of the line, indicating the prevalence of ordinary lung diseases, bears no direct relation to the prevalence of consumption. It is true that both Liverpool and Manchester are severely visited by both types of disease, but on each side of them stand many places in which there is no such correspondence to be seen.

Modes of Infection by the Tubercle Bacillus.

From what has already been said, it will have become abundantly evident that although we have not prejudged the question of contagion, yet that we regard tuberculosis as an infective disease, mainly deriving its origin from without the body, and that, in searching for its mode of entrance into the human frame, we must examine all the possible portals through which it can pass.

Now, there are four possible modes of access to the interior of the body: the skin, the generative organs, the digestive tract, and the lungs.

The first two are, I believe, comparatively rare sources of infection.

Tuberculosis is, indeed, inoculable by the skin, and there are on record cases in which it has thus been accidentally contracted. For instance, in Verneuil's "Études sur la Tuberculose" (Paris, 1887) there are several such cases given, but the local disease did not spread to internal organs.

Cases of such generalization of the virus are, indeed, occasionally heard of; thus, in the prospectus of the congress held in Paris in 1888, reference is made to an experiment of Villemin's in 1869, in which a cutaneous surface, denuded by means of a blister, and powdered over with dried and pulverized tuberculous sputum, gave rise to general tuberculosis, and again, in the discussion held at the Academy of Medicine in Paris (December 3d, 1889), on prophylaxis against tubercle, Monsieur Nocard cited the case of a certain veterinary surgeon, named Moses, who was wounded in the hand during the examination of the body of a tuberculous cow, and who at first had cutaneous tubercles on the cicatrix, and afterward

developed symptoms of phthisis, of which disease he died two years later.

These exceptional cases, however, only serve to show the rarity of the occurrence.

The most common mode of origin of scrofulous lymphatic glands is well known to be some previous lesion of the skin or mucous membrane, through which the virus has made its entrance; but, usually, the disease is arrested by the suppuration of the gland. Lupus, also, which is now generally acknowledged to be a tuberculosis of the skin, does not usually spread to the general system. On the whole, then, I believe that infection of general tuberculosis by the skin is a comparatively rare event.

Infection by means of marital intercourse is also probably very uncommon. It is impossible to say that it may not occasionally take place, especially in view of the observations of the French pathologists, which have already been quoted, as to the presence of the specific bacillus in the generative organs and in the semen.

Food.

In former times the discussion of the question of the production of tuberculosis by food was limited to the subject of the adequacy of certain foods, and the quantity required to sustain the bodily vigor to such an extent as to prevent the tubercular diathesis, as it was called. But so soon as tuberculosis was recognized as an infective disease, experiments were made that proved the possibility of the entrance of the disease through the digestive tract. Both Villemin and Cornil succeeded in producing tuberculosis by feeding animals with tuberculous material, and their researches have been confirmed by others, notably by Von Wesener. The question as to the suitability for food of the flesh of tuberculous animals is undoubtedly one of enormous importance. It has been stated (Dr. Behrend) that as much as 80 per cent of the meat sent to the London markets came from such animals (this must be an exaggeration, as the Departmental Committee on Tuberculosis in 1888 reported to the Privy Council that the proportion of tubercular disease among cattle slaughtered varies from 0.02 per cent at Edinburgh to 50 per cent—Quest. 4,263), and in many places the prevalence of the disease among

cattle has been found to be so great that it has been proposed, and in some places it has actually been decided, to place an absolute veto upon its sale.

Extreme differences of opinion, however, prevail as to the necessity for so greatly restricting the supply of animal food.

On the one hand, at the Congress on Tuberculosis, held in Paris in July, 1888, M. Nocard urged that if any animal presented signs of tubercle in any organ, howsoever localized, it should at once be rejected as unfit for food, and he was followed by other speakers on the same side, with the result that a resolution was passed by the congress that "all meat derived from tubercular animals, whatever the gravity of the specific lesions found in them, should be seized and totally destroyed."

Dr. Behrend, in a paper in the "Nineteenth Century" review for September, 1889, strongly supports this view, and quotes Dr. Klein in its favor, and ascribes the supposed immunity from tubercle enjoyed by the Jews to their careful selection of animals for food. (We have already seen that such immunity is by no means general.) This view also is not without some experimental evidence on its side, though Dr. Behrend does not mention it, for in Wesener's experiments swine and rabbits became, several of them, affected with tubercle, after being fed with the raw flesh of tuberculous cattle. Cooking, however, destroyed the virus, and dogs were unaffected.

Toussaint also succeeded in producing the disease by inoculating the juice from the flesh of a tuberculous pig. On the other hand, Kastner,[56] after adopting most rigorous antiseptic precautions, injected the juice from the flesh of twelve beasts, in all stages of tuberculosis, into the peritoneal cavities of sixteen Guinea-pigs, with absolutely negative results. My friend, Dr. Dreschfeld, of Manchester, has made similar experiments with juice from the flesh of six cows, five of them in an early stage of tubercular disease, and one in an advanced form, though no tubercles were found in the flesh. The results from the first-mentioned group were entirely negative, the rabbits injected remaining perfectly healthy; but the juice from the flesh of the cow in a more advanced stage of the disease produced a small crop of tubercles at the place of puncture into the abdominal cavity of two rabbits after the

lapse of from three to five weeks, and material from this tubercular growth injected into another rabbit again gave rise to still more decided tubercle. (Since this was written, these observations have been extended to ten cows in all; of these, six have now given negative results, three, in which the flesh was in an obviously unhealthy condition, have produced tuberculosis, and one, the flesh of which was apparently healthy, caused the disease after a lapse of three months.)

The evidence as to the transmissibility of tubercle by the ingestion of milk from tuberculous animals is much more distinct and positive as to its occurrence, even when there was no general infection in these beasts; and when we consider the enormous amount of mesenteric and visceral disease that exists at the present day among young children, it becomes a matter of extreme importance to the state that the bearing of this evidence should be made widely known, and that it should be followed by measures directed to avert the evil.

In the Registrar-General's Report for 1888, the deaths of 3,659 males and 3,115 females are ascribed to tabes mesenterica, and 3,722 males and 3,021 females to tubercular meningitis. Hirschberger declares that 25 per cent of all children dying under one year of age die of tuberculosis.

It is assumed that many of these cases are directly the result of intestinal infection by the bacillus.

Bacilli have been found by Bang[57] in milk, both when the udders of the tuberculous cows were affected and when they were not, and he obtained constantly positive results by feeding with the former, and occasionally with the latter, and he found that heating the milk to 70° C. did not always destroy its virulence. Only boiling would entirely do so.

Ferdinand May and Gottlieb Stein have made similar observations; but these researches are open to objection, on the ground that tuberculous material may have entered the milk from without; and, on the other hand, the digestive juices may act destructively on the infection when it is actually present.

On these grounds Dr. Hirschberger, under the guidance of Professor Bollinger, instituted a series of experiments in which extreme care was taken to avoid these possible sources of error. The milk was obtained in two ways: 1, by milking into glass vessels, sterilized by heat; 2, by drawing it directly

from the udders of recently-slaughtered beasts, antiseptic precautions being strictly observed. Guinea-pigs were the experimental animals employed, and the milk was injected into the free peritoneal cavity. The animals were always young and fresh on the market, and they were kept under excellent hygienic conditions. A very large number of the animals contracted tubercle, even when, as in these cases, the udder itself was unaffected, and although, out of twenty udders used, in only one was the presence of bacilli demonstrated by the microscope.

In only six cases was no infection obtained, and even when the cows were in otherwise good condition, which seven of them were, positive results were obtained in three cases.

He concludes from his researches that there is great danger attending the consumption of milk from tuberculous animals, in whatever condition they may be, and whether or not the disease is localized only.

Other observers, such as Von Wesener, Fischer, Baumgarten, Bollinger, Johne, and Martin and Queyrat, have also investigated the subject, and although they differ somewhat as to the exact track of the disease, they agree on the whole in regarding as dangerous the use of the milk of cows who are tuberculous, even when they only have the "pearl disease." Fischer and Baumgarten have shown, morever, that the tubercle bacilli are not deprived of their power for evil by the action of gastic juice, and Dr. Behrend quotes MM. Strauss and Wurtz as coming to a similar conclusion.

In the presence of facts such as these, we cannot deny the possibility of the transmission of tubercle by means of the flesh of cattle, and it is highly probable that mesenteric and intestinal disease is not infrequently produced, especially in children, by the use of infected milk; but there are certain broad considerations that should, I think, prevent us from attributing much of the phthisis that prevails to either source of infection, and this in spite of Bollinger's observation that the lung may become affected even when the tuberculous matter is introduced by the intestinal canal or the peritoneum. Thus we do not find that the classes who eat most meat are those who are most commonly attacked by phthisis. Among our poor phthisical patients, how many there are who do not taste butcher's meat from year's end to year's end, and again,

when the lower orders are able to procure this luxury, it is well known that they prefer it over-cooked rather than underdone; and the persons who, as we know, are the most subject to tapeworm, from picking at raw meat—namely, butchers and cooks—are far less liable to phthisis than other classes of the community.

It would be interesting also to know how those who ascribe such dire results to the eating of the flesh of oxen would account for the fact that in India, the Hindoos, who abjure such meat, are as subject to phthisis as the other races (Lombard, "Climatologie Médicale," IV., 417: "L'on voit dans les hôpitaux de Calcutta des phthisiques européens, hindous, mahométans et juifs." I have already pointed out the tendency of the Jews of Alexandria to contract the disease. See Virchow's "Archiv," 1883 or 1884. Schottelius), and also why the Gauchos of South America, who subsist almost entirely upon beef, are so remarkably free from the disease. Dr. Thorburn, of Toronto, tells me that the North American Indians, who now get no meat, are terribly subject to consumption.

Somewhat similar remarks apply to the use of milk, for the poor denizens of our towns, among whom phthisis and mesenteric disease are most common, are often unable to procure milk; but it must be acknowledged that when they do obtain it, it is more likely to be obtained from diseased animals, and also more open to contamination by tuberculous dust in the small milk-shops in which it is stored. Still the comparative rarity of the disease among the children of the rich, who consume it largely, and who very seldom will take it after it has been boiled, shows that the danger from this source is not quite so serious as it has lately been represented to be, both in this country and on the Continent.

The measures to be taken for averting the danger will be indicated in the next chapter.

The Atmosphere.

The next medium through which the bacilli may be conveyed is the air.

We have already seen the close connection that exists between foul air and tubercular lung disease, and we have studied some of the circumstances in which the bacilli may

find a resting-place in the lungs, and under which they may develop into true tuberculosis.

But we have not yet determined the exact nature of the media through which these organisms are conveyed into the lungs—1, whether it comes directly from mouth to mouth, or, 2, whether it comes indirectly from the sputum of phthisical persons—dried up, for the most part, and flying about in the air of dirty rooms or crowded assemblies in the form of dust. And the further questions arise whether the bacillus is kept alive, or its virulence increased, outside the body, either by the presence of aqueous vapor, or by emanations from the soil, or by other organic impurities connected with certain localities or certain dwellings.

1. Direct contagion—from mouth to mouth. In discussing the communicability of phthisis there has been a want of precision in putting the question as to whether direct or indirect contagion has in certain cases caused the disease. There can be little doubt, however, that, in the minds of most of those to whom the question has been put, it was the first or direct form in which it has presented itself.

The word contagion implies transmission by contact, and in the case of phthisis it would naturally be taken to mean the direct transference of the disease from person to person —in the words of Timon of Athens that "Breath infects breath."[58]

That contagion from a consumptive patient is a possible event, is an opinion that has been held by many eminent men —Morgagni, Van Swieten, Valsalva, Morton, and Baumé among the ancients; Laennec, Copland, Bowditch, Dr. Wm. Budd, Dr. Gueneau de Mussy, and Dr. Hermann Weber in more modern times. All these observers have expressed their view that the disease is contagious; and although there are many others on the opposite side, affirmative evidence is, in this case, of more value than negative. In Italy and Spain, as is well known, the disease is treated as contagious, and after death the bedding is destroyed and the dwelling thoroughly fumigated and cleansed; quite recently, too, a number of supposed cases of contagion have been contributed by medical men to the Collective Committee of the British Medical Association; and on the first perusal of the "Collective Investigation Record," it would seem to be impossible to doubt

that, although the contingency may be a rare one, the possibility of such direct infection has been proved. I have myself shown, however, that the importance of these cases is liable to be exaggerated, and that they afford but little certain proof of the direct contagiousness of phthisis. In a paper on "The Limits of the Infectiveness of Tubercle," I have pointed out that when checked by means of Dr. Longstaff's formula, supplied by the committee themselves—the number of cases of phthisis in husband and wife, supposed to be due to contagion, is less than it would have been, had only accidental and non-contagious cases been admitted into the record.

Moreover, we have to take into account the possibility of contagion by sexual intercourse (it may perhaps be regarded as favorable to this view, that in 188 cases reported to the Collective Investigation Committee, 119 are of supposed transmission from husband to wife, and only 69 from wife to husband [Report, p. 33], and Dr. Weber's experience is to the same effect); and the certainty that, in most of the cases of supposed direct infection, all the persons whose cases are noted were exposed to the same risks arising from unhealthy environment; and again, if phthisis were directly contagious, it is remarkable that it should be chiefly contagious in badly-ventilated houses, and on certain soils; and it is further difficult to see why drainage of the land, and elevation above the sea-level, should in any way affect its contagiousness. Even good ventilation could hardly prevent a husband and wife, or other bed-fellows, from communicating the disease, and yet such an occurrence has rarely, if ever, taken place in well-ventilated houses. In the Report of the Collective Investigation Committee, Dr. Dewar, of Arbroath, makes the significant remark, that in all his cases of supposed infection (No. 166), "the patients lived in small, confined houses, and slept in the 'box-beds' in use in Scotland." "During twenty-five years," he says, "I have not seen one case of contagion in the airy houses of the well-to-do."

It is worthy of note that most of the physicians who have had the widest experience of phthisis are non-contagionists; thus Dr. C. T. Williams pronounces strongly against it, and gives statistics from the Brompton Hospital which are entirely opposed to the theory of contagion.

Dr. Pollock also says:[59] "It can be shown that after an experience of thirty-six years, during which the hospital has been established, not only has no infecting process been evidenced, but that the medical officers and nursing staff, and the officials and servants, have been unusually free from phthisis."

Dr. Andrews does the same from the city of London Hospital for Diseases of the Chest, and in his Lumleian Lectures for 1884 adduces several of the considerations against the theory, which had already occurred to myself before seeing his lectures. He concludes that "there is not sufficient evidence to prove that the prevalence of phthisis is especially affected by direct contagion."

Dr. Bennet, after twenty-five years' experience, says[60] that "if there has been any spread of phthisis at all by means of contagion, it has occurred very seldom, and only in quite exceptional circumstances." In his summing up of the evidence on this point, Hirsch remarks[61] that "contagious transmission of phthisis plays but a subordinate part in the spread of the malady."

Baumgarten says:[62] "Der Ursprung durch Inhalation, als Regel in hohem Grade unwahrscheinlich erachtet werden müsste." Ricochon[63] answers the question, "Can contagion arise directly by respired air?" by saying that "experience is not favorable to this idea." Verchère[64] holds the same opinion, and many other quotations of a similar import could be brought forward. (Francis Galton, "Natural Inheritance," p. 180, points out that, among the families from which his statistics were derived, only eight of the consumptive fathers had tuberculous children, and sixteen of the mothers; and he remarks: "So far as it is contagious or infectious, we must recollect that the child is peculiarly exposed during all the time of its existence before birth to contagion from its mother. During infancy it lies in her arms and afterward lives much by her side, closely caressed, and breathing the tainted air of her sheltered rooms." The explanation of the fact that we have been discussing appears, therefore, to be summed up in the single word "infection." But this does not exclude indirect infection from dust.)

2. As to the dissemination of phthisis by means of dust, it is well known that Koch regards this as the most common way in which it is produced—by the drying up and pulveriza-

tion of matter expectorated upon the ground, or on the floors of dwellings, or on handkerchiefs.

Cornet[65] has also warmly taken up this view, and by a series of experiments upon animals has proved the infectious qualities of dust obtained from the walls in the immediate neighborhood of phthisical patients. In one case this dust produced tuberculosis, when removed from the wall of a room, six weeks after the death of the consumptive woman who had lived in it. In another, a room at an hotel was proved to be thus infected, and he points out the danger of infection from matter expectorated on the ground, or into handkerchiefs, and even from the dust of books in lending libraries.

Long before the discovery of the bacillus of tubercle also, this view was taken by some of the most competent observers; thus, Dr. Farr, in his Report to the Army Commission, remarked that "the prevalence of phthisis in the armies of Europe is probably due, in part, to the inhalation of expectorated tubercular matter, dried, broken up into dust, and floating in the air of close barracks."

Mr. Welch, in his prize essay "On the Nature and Varieties of Destructive Lung Disease among Soldiers," says: "The chief deleterious agent in the generation of consumption is the organic matter, which, taken into the air-passages, there lodges and chronically irritates."

Dr. Parkes apparently held the same view, for he speaks of "phthisis and other lung affections, which may reasonably be believed to have their origin in the constant breathing of air vitiated by the organic vapors and particles arising from the person."[66]

I have ventured to ascribe most of the cases mentioned in my paper on "Tubercular Infective Areas," and especially the double and treble occurrence of the disease in the same houses, to this source of infection.

The retention of the bacillus either in dust, or in the vapor of the air, would fully account for the most of the cases of supposed direct infection recorded by the Collective Investigation Committee, and especially for those in which the virus appeared to be introduced from without into houses previously entirely free from the disease.[67] It accounts fully for all the additional cases mentioned by Dr. Burney Yeo, in his able defence of the doctrine of contagion in the "British Medical Journal"[67] (April 18th, 1885.)

The following case recorded by Dr. Niven would also come into the same category:[68] "A married woman from Oldham, went with two children (one a lad æt. 10) to Southport, to join her husband, in September, 1887. The husband, wife, and the two children all slept in one front room. In the same house was a woman suffering from consumption, which was said to have been contracted from her husband, who had previously died of the same disease. (This woman is since dead.) As the weather got colder, this consumptive woman asked them to change rooms with her, as her bedroom was colder than theirs. This was done. The Oldham woman used to complain of a peculiar odor in the room; it does not seem to have had any special cleansing or disinfection. In January, 1888, the lad, æt. 10, died of "inflammation of the brain;" he had been ill a month. From the history, his fatal malady was almost certainly tubercular meningitis. The Oldham woman became *enceinte* in Southport, but removed shortly afterward to Oldham, and was there confined in June, 1888, but before the birth of the baby, she lost flesh, and showed the first symptoms of phthisis. The baby died in June, 1889, of tabes mesenterica, and she died in October of phthisis."

The terrible mortality from phthisis that has been observed in convents is most probably to be accounted for by the combination of bad ventilation, and want of perfect cleanliness and of care in the removal of sputum-laden dust.

Laennec himself, in his classical work on phthisis pulmonalis, gives an instance of this in a religious community of women kept in strict seclusion and with sombre surroundings, among whom he had seen consumption arise so frequently, that in ten years' time the population of the institution had been two or three times renewed, owing to the mortality of the inmates, with the significant exception of those who had charge of the gardens, the kitchens, and the infirmary.

(The following case is given by Dr. Beddoes in his "Hygeia," upon the authority of Dr. Luzuriaga: "A nun died at Bilboa of consumption; the furniture was burned, the walls, ceiling, and door washed, the floor taken up and sand laid in its place. The cell was then tenanted by another nun, in perfect health and of an excellent constitution. In two months she began to decline, her flesh wasted, the chest

was attacked, the cough became worse and worse—in short, she died consumptive in eight months after taking possession of the cell. General purification as before. A third healthy nun succeeded and died in the course of a year. New examinations took place, and it appeared that the cord near the bed, attached to the dropping-bolt of the door, had not been removed. This, it was said, was impregnated with the sweat of the patients and with other noxious exhalations. It was removed, new furniture introduced, and a fourth nun has lived in the same cell for five years."—Essay VII., p. 95. The "London Medical Record" for July, 1884, quotes a similar case by Dr. Kempf, of Louisville.)

But the most striking series of statistics on this point is given by Dr. Cornet,[69] who, by an elaborate statistical inquiry into the mortality from phthisis among the Catholic nursing orders in Germany, shows that the deaths from tuberculosis form nearly two-thirds of the total deaths, and in half the returns this proportion was exceeded, and in some mounts up to three-fourths. In two small mother-houses every death was put down to tuberculosis. Dr. Cornet ascribes this fearful mortality to infection from dried-up sputum.

3. We have now reached, perhaps, the most difficult part of our inquiry—as to whether any conditions outside the mere presence of the bacillus are necessary, or at any rate auxiliary, to its infective power.

We still need an explanation of the facts: (*a*) that free ventilation is antagonistic to its influence, and that, under this condition, it does not spread from person to person under circumstances of the closest possible personal contact.

(*b*) That its prevalence is greatly affected by a certain elevation of the site of dwellings.

(*c*) That it is more deadly and rapid in its action in hot, damp climates, and less common in cold and dry countries.

(*d*) That dampness of the subsoil under dwellings has a distinctly favorable influence in promoting its attacks.

(*a*) With regard to the influence of free ventilation, it is not only possible, but highly probable, that in many of the places where its good effects had been observed, other conditions as well have come into operation, and especially greater cleanliness and more complete removal of dust and other refuse.

Where people care for fresh air, they also frequently show a preference for cleanly surroundings, both of house and clothes and person.

It is true that this consideration is not universally applicable: there are many very dirty dwellings that are well ventilated, as in the wattled huts of the Labrador fishermen, or the loosely-constructed dwellings of the island of St. Kilda, and yet the inhabitants are almost exempt from the disease; but in these cases, apart from any disinfecting action of the air, or peat smoke, it is open to us to suppose that a good deal of the infective dust is swept away by the currents of air.

It may thus be possible to account for the absence of indirect infection through the medium of dust, in these places; though, as I have before remarked, it will not explain the non-occurrence of direct mouth-to-mouth infection, which may therefore be considered as rarely, if ever, operative.

(*b*) Somewhat similar remarks may apply to the influence of an elevated site upon even indirect infection through dust, for in these situations we probably have both more movement of air and less dust. We may also suppose that the health-giving properties of such sites would give to the dwellers upon them more power to withstand the bacillus, so that they could take in with impunity larger doses of these infective organisms.

In most cases, too, the rocks, or the subsoil, on which the houses stand, would supply to their inmates a purer and less vaporous ground-air than in less elevated regions.

(*c*) But no such explanations as these will touch the remaining two points that we have to consider. If there is no condition outside the body that influences the viability or virulence of the bacillus, it is very difficult to account for the comparative immunity of frosty or sub-arctic regions, and for the intensity of the tubercular action in hot or tropical climates. It is certain that chronic inflammations of the lungs are not more common in the latter, and thus one source of disease is not so frequently present, while in the cold regions, where these affections are rife, phthisis is comparatively rare, and much less virulent.

We have no reason to suppose that bacillus-laden dust is absent in the crowded towns and close rooms which are to be found in Canada, for instance, and yet the disease does not

spread as it does in the warmer and more genial air of Italy and the tropics.

(*d*) Again, it affords no explanation of the influence upon such infection of damp or undrained subsoils. Nor yet of the improvement in the phthisis-rate that has been shown to follow thorough drainage of a town.

As Dr. Andrew points out,[70] "It is difficult to understand in what way the drying of the soil . . . could have so profoundly and so rapidly altered the constitution, habits, and vitality of the people of Salisbury, for instance, and of other towns, as at once to reduce, by a very large percentage, the number of cases of a developmental, or directly contagious, disease."

To account for these several points, it is necessary to assume the existence of some conditions accessory to infection by the bacillus, which shall either enable it to live longer outside the body, or which may even increase its power of attack.

It may, indeed, be sufficient to account for the facts, if we assume the first of these hypotheses to be true, and if it could be proved that a hot climate, and a damp soil, give a longer term of life to the bacilli contained in foul and dusty air, for this circumstance would increase the probability that some of these organisms would find a suitable host; but I am inclined to think that something more than this is necessary, to account for the difference in intensity of bacillary infection in pure air, and that reeking with organic vapors.

I have, therefore, ventured to suggest that the tubercle bacillus, like some other infective microzymes, may actually increase in virulence during a sojourn for a time in some medium external to the body—either in polluted ground-air, or in an atmosphere saturated with aqueous vapor from the lungs.

There is nothing in the natural history of such organisms that need run counter to this theory, and as it has been shown by Dr. Thiersch and Professor Burdon-Sanderson, that the intensity of the poisons of cholera and enteric fever increases after their extrusion from the body, so it may be possible that contact with a certain kind of organic matter may assist the sporulation of the bacillus of tubercle, and render it more infective after a time, than at the moment of its exit from the lungs of a phthisical patient.

I do not know whether the same observation has been

made by other physicians to consumptive hospitals, but it has certainly struck me that a fresh infection of the lung, in persons already suffering from phthisis, is much more likely to take place from without, than from within the body. Many times have I seen in-patients with sputum teeming with bacilli, improve in health, gain weight, and almost lose the physical signs of their disease, and then they have returned home and in a few weeks they have come back to the hospital, sometimes with fresh disease in the damaged lung, sometimes in the opposite lung that had been previously healthy, and sometimes with laryngeal phthisis.

Such facts as these certainly seem to show that there was something in the air of their own homes much more infective than the bacilli of which they were themselves the hosts. The one fact that might seem to bear against this theory is the high temperature required for the development of the organism. And the greater virulence of the disease in hot climates probably shows the influence of this condition, but it is by no means proved that, in cold climates, the bacilli contained in damp and foul dwellings may not in some way increase their power for evil. (On this point Dr. Candler remarks: "I demur to the somewhat authoritatively pronounced dictum that it follows that the bacillus is a pure parasite from the one fact that it could not be got to grow outside the organism, except at blood-heat. The inference is by no means an inevitable sequence from the fact, for the fact does not take in enough to found such a weighty conclusion upon.

"It simply amounts to this—that the development process of the bacillus did not occur at ordinary temperatures during the highly-artificial cultivations required in Koch's investigation. And one has to suppose, from the inference drawn from it, that this fact was regarded as equivalent to proof that the bacillus cannot be cultivated at ordinary temperatures under any conceivable artificial conditions. It would seem to have been assumed that because it did not grow in one series of experiments it was a certainty that it would not grow in any other series. But, as all possible combinations of soils and conditions were not exhausted in Koch's research, who shall say that some other investigator, or Koch himself, may not yet successfully cultivate this bacillus at ordinary temperatures?

"Again, even if it be granted that it shall be found impossible within the next ten or twenty years to cultivate the bacillus below blood-heat, it would not follow of necessity that there might not be an undiscovered means of growing it, as any one who knows the history of the common yeast-form will readily apprehend. Moreover, if this bacillus should defy the efforts of man during all time to cultivate it below blood-heat, he may nevertheless have been contributing, undesignedly, to its growth, and it may have been growing luxuriantly all around him, in the flora of temperate countries.

"Therefore I submit that Koch's premise in this matter does not sustain the conclusion, and that the whole question of the botanical position of the tubercle bacillus is an open one."—"The Prevention of Consumption," p. 10. Kegan Paul & Co.)

I will conclude with yet one more striking case, quoted also by Dr. Andrew, from Mr. Fleming,[71] which it seems to me impossible to explain without some such hypothesis:

"A large farmer at Leinheim (in Alsace) for five years in succession lost one cow from phthisis, and always in the same stall. A sixth animal, selected for its vigorous health, and the absence of any taint of phthisis in its pedigree, shared the same fate. Then all the wood-work of the stall was removed, the manger and rack thoroughly disinfected, and the spot left unoccupied for some time. It was then rebuilt and reoccupied by several animals in succession, but tuberculosis made no more victims among them or in any other part of the stable." As Dr. Andrew remarks: "In this case the disease must have been transmitted by some non-volatile substance in the stall itself; otherwise, and if the breath of the tainted animals had been infectious, it is difficult to believe that its neighbors on each side, for six years, could all have escaped unhurt. . . . It may have been an instance of local, not of personal, infection."

CHAPTER IV.

THE PREVENTION OF PHTHISIS.

We have now completed our survey of most of the conditions that are favorable or unfavorable to the development within the body of the bacillus of tubercle, and we have found that they may be briefly summed up under the following heads:

1. Congenital taint or inherited proclivity to the disease.

2. Tendency to the disease acquired by unhealthy modes of life, and especially by such as produce actual lesions of the parts into which the organism can make its way.

3. Sources of possible infection, or means of access through which it may gain an entrance into the system.

4. Conditions that foster and keep alive the organism in the immediate neighborhood of persons susceptible to the infection.

We are now in a position to consider what is possible to be done, and what should be attempted, to prevent the disease from attacking both human beings and animals associated in some relation or another with human beings.

1. With regard to inherited tuberculosis, or inherited vulnerability by the virus, if we were to accept Professor Baumgarten's theory of the chief mode of origin of the disease, namely, by spores, that like the pangenetic "gemmules" of Darwin, are implanted in us by our ancestors, and that may or may not remain latent all our lives, we should indeed despair of ever casting out this plague from our midst; for, even supposing that it was possible either to prevent all consumptives from marrying, or to keep their offspring under such conditions that the disease could not develop, it might still be transmitted through the second or third generation, and might break out at some subsequent period.

But it is quite otherwise with regard to inherited predisposition, if this consists, as we believe it does, mainly in a vul-

nerability only, and if, in nearly all cases, the actual germ of the disease comes from without the body. In this case it is quite possible to save even susceptible persons, by keeping them out of the way of infection, by clearing away the sources of the virus, or by doing away with the conditions under which it can exist, or by which it may be kept alive and ready to make its way into the system.

Doubtless, in view of the certain fact of inherited bodily qualities, and of the possible transmission of the disease congenitally, it is highly important to do what lies in our power to deter consumptive persons from marriage. But when we cast about for the means by which this may be accomplished, it soon becomes evident that they are very few and inadequate. It would of course be quite useless to attempt legislation, for restrictive laws on this subject could not be carried out in this country.

Certain writers have indeed laid down an elaborate series of prohibitory rules, forbidding marriages of consanguinity, and between the members of tuberculous families (Ancell, "Tuberculosis"); but even they acknowledge the impossibility of enforcing such rules. "Love laughs at locksmiths," and would certainly not submit to be bound by the chain of a prohibitory measure, even if one could be passed.

Still no one can doubt the importance of endeavoring to secure a healthy public opinion on the point, and fortunately most intelligent people are already, for the most part, on our side. Darwin's researches on the danger of breeding in and in, and on the advantages of cross-fertilization, together with the general experience of the breeders of stock, on the advantages of the selection of suitable and healthy strains, and the patent facts relating to family inheritance of phthisis—all these things have combined to make the heads of families cautious in sanctioning marriages with individuals suspected of having a tuberculous ancestry.

Medical men and ministers of religion may do a good deal to strengthen this feeling, and to discountenance marriages between relations, especially when the family has been tainted by tubercle; also, by pointing out the facts that have been ascertained as to hereditary tendency to disease, they may often succeed in preventing the marriage of tuberculous individuals.

But when, in spite of all such checks, these marriages have taken place, I believe—notwithstanding Professor Baumgarten's opinion—that much may be done to save the offspring from the disease.

A father or a mother whose partner has died of phthisis, and who has been left with children to bring up, may certainly hope to save them from the fatal inheritance, if due care is taken in their rearing and in their choice of occupation, and this is especially the case if the children have not been suckled by a consumptive mother. When this condition has been complied with, as it certainly should be in every case, the ordinary hygienic rules for infancy and childhood will, for the most part, suffice to keep the children in health; a well-drained, high, and airy site for the dwelling, entire cleanliness of house, clothing, and person, fresh air and light, abundance of good food, due exercise and rest, care during illness, and so on. I would, however, especially emphasize certain details of the hygienic code—thus, that milk and easily-digested fats should form an adequate part of the dietary, and that the milk, in every case where there is a tendency to tubercle, should be scrupulously boiled, and in some cases peptonized, or used as koumiss or junket.

Free ventilation is especially needed in apartments occupied by persons, whether children or adults, with a tendency to consumption.

Dr. MacCormac[72] gives a number of striking instances of the value of hyper-ventilation in warding off consumption. He also gives a graphic picture of his own practice in this respect. He says: "I would speak in especial of a chamber which I once entered, as I had often before entered it, early one winter morn. It was the sleeping-closet of my son. His low trestle-bed stood betwixt the severally widely-open window and door, while the keen but exquisitely fresh sweet atmosphere from wind-swept hills careered through the apartment ceaselessly. The hue of exuberant health mantled over the boy's every feature, while, bordering the margin of the coverlet, there extended a fringe of pure white snow, which the genius of the fragrant night had wafted in all harmlessly during the hours of my child's repose" (p. 7). Truly it needs an enthusiast to carry a principle so far as this, but I should be glad if something very little short of it were adopted in

every night nursery in the kingdom—if it could be said of all of them that

> Through the half-opened casements now there blew
> A sweet fresh air, that of flowers and sea
> Mingled together, smelt deliciously.[73]

Then, as to exercise, it should be such as to develop the chest as much as possible—not only by games, though this is the best method, but also by carefully graduated and adapted gymnastic exercises. It should also, as much as possible, be carried on in the open air, and with as little dust in the atmosphere as practicable.

Especial care must be taken during and after the illnesses to which childhood is liable. After measles and whooping-cough thorough examinations should be made to see that there is no lingering affection of the lungs, and that the chest is not left deformed in any way. The attendants should not rest satisfied with anything short of complete recovery, if this can by any means be attained, either by medicinal agents, or gymnastic exercise, or by change of climate; and equal care must be exercised after any of the exanthemata. Where enlarged lymphatic glands are left, they must be regarded as a possible source of danger, especially when they are the sequel to some external eruption or sore.

Where the parents are rich, care should be taken with regard to education—that it should not be over-pressed, and that it should be carried on in well-ventilated rooms, and if a boarding-school has to be selected, it should be one on a high and dry site, and not only the school-rooms but the dormitories should be inspected, to see that there is sufficient cubic space, and also that the warming and ventilation are properly carried out. Whenever possible, it would be well to choose a cubicle or bedroom where the window can be kept open at night, winter and summer.

Let both boys and girls have an abundance of open-air life, and play games such as cricket and tennis, that promote healthy exercise; let them be allowed to walk and run, or ride, as much as they can consistently with other duties. Let the boys hunt, shoot, or row; let them camp out, climb mountains, or spend their holidays in the country, or at the seaside, in healthy lodgings.

If it should be necessary to choose a business or profession, let it be one in which there will be but little office work and as much out-door employment as possible. In such cases as these the prospect of future gain must not be allowed to compete with the pursuit of health, and hence, one with less remuneration and future emolument must often be preferred. Let a boy choose to be a farmer, a breeder of cattle, at home or abroad in some suitable climate, or a land steward or agent, or a surveyor or civil engineer. In a lower grade, other occupations may have to be selected, such as that of an agricultural laborer with all its hardships, a sailor, or fisherman, a carter, butcher, cab-driver, railway guard, or even costermonger. I well remember one member of the latter craft who was in the third stage of phthisis, who had been attending the Addenbroke Dispensary for nine years, and whose disease certainly did not advance during the time that he was under my observation there—a period of three years—and such cases could be abundantly multiplied.

Something more needs to be done for the children of the poor by various public bodies, especially in the direction of securing better methods for the warming and efficient ventilation of schools.

Sir Henry Roscoe, in a recent paper, "On the Ventilation of Schools,"[74] deduces from the researches of Professors Carnelly and Haldane, the conclusion that "our primary schools are, as respects healthy atmospheres, in a deplorable condition," and he thinks that the secondary schools and private advertised schools are far worse than board schools. "We must not rest," he says, "until all our future elementary schools, to say nothing of the private schools, are ventilated by mechanical means, and the health of our children, physical and mental, is brought above the very low level at which it now stands."

2. Many of the remarks now made will apply, at any rate in principle, to the subjects of an acquired tendency to consumption. Those who have been sufferers from any weakening disorder, such as have been enumerated as a cause of this tendency, will have to be sedulously guarded against the entrance of the tubercular poison into their systems, and they must be rigorously debarred from all crowded assemblies.

With regard to affections of the lungs, however, I think we may use some discrimination in selecting cases that must be submitted to the restrictions it is needful to impose upon those most prone to phthisis.

Thus it is necessary that, during attacks of acute bronchitis, pleurisy, broncho-pneumonia, and other inflammatory complaints, care should be taken to secure the complete resolution of the disease; but when this has been attained, and the full elasticity of the lungs has returned, it has not been within my experience, that persons who have suffered from these complaints are more liable to consumption than other people, though of course subsequent attacks may at last leave the lungs more vulnerable by the disease.

After all these complaints, and especially after pleurisy, there is undoubtedly danger, so long as there remains any contraction of the chest, and want of full expansive power. It is well known how frequently phthisis follows pleurisy, and although this may in some cases be due to the fact that the pleurisy itself is of tubercular origin, in others the tubercular infection is grafted upon the injured organ at a period too remote from the original disease for it to have been its immediate precursor.

I have been in the habit of testing the movements of the chest with the stethometer in most forms of pleurisy, and in all cases where these movements are impaired by the attack I have formed an unfavorable prognosis, an opinion that has only too often been confirmed by the result, though in several cases the supervening phthisis has been some years before it has made its appearance.

There seems to be less reason to dread the occurrence of phthisis in chronic bronchitis, asthma, and emphysema, but I cannot altogether share the opinion of Rokitansky as to the immunity enjoyed by sufferers from the latter complaints, as I have several times seen their association with phthisis.

I should imagine also that in the partial emphysema that arises from atelectasis or impairment of certain portions only of the lung, a deposit of tubercle is but too likely to take place in the portions thus injured.

Still greater danger is also acknowledged to arise from accidental hemorrhage into the lung-tissue. Although hæmoptysis is frequently only a sign of incipient tubercular disease,

I am convinced that it is also sometimes simply its precursor, and the resulting phthisis has in my experience been more acute in its course. In this class of cases also the stethometer has been of no assistance in prognosis. I may remark here that, as an additional precaution against infection in this class of cases, and in all in whom there is a predisposition to phthisis, and when its subjects are obliged to attend crowded assemblies of any kind, I have been in the habit of recommending the temporary use of respirators charged with eucalyptol, so as to minimize the danger of inhaling tuberculous material.

I need not linger over the precautions that should be taken in the case of dusty work, especially such as involves the production of sharp, irritating particles; workingmen are now much more alive to the danger arising from it than they were formerly, when, as Dr. Hall, of Sheffield, tells us, the file-grinder looked upon early mortality from lung disease as inevitable, and rather welcomed it, as affording a chance of more speedy promotion.

It is probably still hopeless to expect that workpeople will use respirators to catch the dust on its way to the mouth, but fans are now almost universally employed to sweep it away from the worker.

It would, however, be a good thing if these people could be more frequently warned of the necessity of attending to the first beginnings of lung trouble, as we know that, in their first inception, many of these cases are not tuberculous.

In all cases of incipient chronic lung disease, wherever possible, an attempt should be made to obtain plenty of fresh air and sunshine, whether by change of climate or otherwise. I venture to put this matter in these terms because I believe that, in the treatment of such cases, wherever a dry, pure soil and germ-pure air exist, that is the best health-resort in which the largest amount of out-door occupation can be secured, together with the greatest amount of bodily comfort.

Hence it is that Davos Platz and San Moritz can vie with the Riviera and Algiers; Canada, with California and Mexico; the highlands of Africa, with the Canaries and Madeira.

3. With regard to the ingestion of tuberculous food, it is probable that too great laxity prevails in the inspection of

butchers' meat, and that its sale should be subject to more stringent regulations than it now is in our large towns. In France, by a decree passed in July, 1888, it is provided that "whenever the tubercular process affects the lining membrane of the chest or abdomen, the entire carcass shall be condemned," but in most other countries it is considered sufficient, when the disease is entirely local and not generalized, to cut out the diseased parts and suffer the meat to be sold, if otherwise sound and the beast well nourished. Professor Koch, himself, thinks there is no danger in this practice, and this opinion is shared by Cornil and Dujardin-Beaumetz in France, by Nosotti in Italy, and by Von Wesener in Germany.

But most of these opinions are based upon the idea that the meat in question should be well cooked, and it seems to me desirable that the Prussian practice should be followed, of plainly labelling meat that is regarded as in the least degree suspicious by the inspector, who should not suffer it to be sold without a caution to the buyer.

Still more decided precautions should be taken with regard to milk from tuberculous cows. Its power of conveying tubercle is fully proved, and its sale should be prohibited. In the mean time, also, as before said, the possibility of infection from this source should cause the heads of families either to make very sure as to the untainted source of the milk supplied to them, or should induce them to insist upon its being boiled before use.

In towns, it is impossible to trace the milk to its source, and the latter injunction becomes, therefore, more imperative. Probably, many more cases of infection from this source would occur in towns if it were not for the fact, pointed out by Bollinger, that the mixing of the milk of many cows diminishes, by dilution, the risk of conveying the disease.

The possibility of tubercle arising from this source, lays a heavy burden of responsibility upon those who have the care of the public health, and this burden, with regard to milk, has now been laid upon the Local Government Board and its subordinate local authorities.

By Section 9 of the Contagious Diseases (Animals) Act of 1886 (amending the act of 1878), the powers of the Privy Council respecting the inspection of cattle, and sanitary precautions relating to milk, are transferred to the Local Govern-

ment Board, and local authorities are empowered to make regulations respecting these points. Unfortunately, tuberculosis is not included in the definition of "disease" in the act, and the Departmental Committee on Pleuro-pneumonia and Tuberculosis report, in 1888, that "although in England and Ireland, under the provisions of the Nuisance Removal Act (as embodied in the Public Health Act, 1885), the medical officer of health, or inspector of nuisances, may seize tuberculous animals, yet such seizure is rarely performed."

The case with regard to milk is even more unsatisfactory. It is, doubtless, now the duty of rural sanitary authorities to supervise all dairies and cowsheds, and to prevent the export of possibly tainted milk; but, again, there is no direct provision against the supply of the milk of tuberculous cows; moreover, the local boards of places where milk is produced are not necessarily in union with the authorities of the places where it is consumed, and the members of the rural local boards are often unwilling to offend the farmers, and others by whom they are elected, and are not likely to take much care in the matter.

What is needed is greater solidarity among the various local authorities, so that the corporation of a town, for instance, might be in communication, through its health officers, with the inspectors in the rural districts from which the milk is supplied to the townspeople. They might thus ascertain directly the presence of disease, whether of man or beast, in the farms supplying the milk.

But even county councils cannot altogether perform the necessary duty of carrying out this organization, for the milk supply of a town may come from several different counties. I know, for instance, that Manchester is supplied not only from farms in Lancashire, but also from those in Cheshire, Derbyshire, Yorkshire, and even Staffordshire.

It is urgently necessary, therefore, that the laws relating to the sale of the flesh of tuberculous cattle, and the milk supplied from them, should be amended without delay, and also that some concerted action should be taken by health authorities with reference to the sale of milk in towns. (I am informed that several towns have obtained private acts, by which it is provided that their judicial officers of health may inspect any dairies, etc., beyond their boroughs from which

milk is supplied to them; and these provisions are included among the "model clauses" which may hereafter be the subject of general legislation. But it is not apparent from these clauses that any power is given to inspect the cows themselves, in order to judge whether they are tuberculous or not.)

4. The next, and I believe the most important, media for propagating consumption are the houses people dwell in, and the rooms in which they congregate together.

Architects and builders of all classes of dwellings have been in the past, and are still, largely responsible for a very large proportion of preventible mortality. It is only right that we should look to them in the future to rectify the mischievous modes of construction—both of mansions, and cottages, and public buildings of all kinds—that have proved such a fertile source of disease, and especially of consumption. It is incumbent upon them both to rectify existing buildings, and to erect new ones upon plans that are more in accordance with modern sanitary requirements. They must see to the exclusion of noxious ground-air from houses, to the prevention of the harborage of dust, to giving sufficiently copious streams of air without draughts, and to the extraction of foul air as soon as it is produced, and to the provision of abundance of light. They are not left without help in this regard. In Sir D. Galton's excellent work on "Healthy Houses," there are ample and detailed instructions as to how these several objects may be accomplished.

Local authorities also cannot plead ignorance in excuse for neglect. The Model By-laws of the Local Government Board, if fully carried out, would to a great extent do away with the merely structural causes of phthisis. The whole of these by-laws are useful; but those relating to the width of streets (4–8), height of buildings (19), space around houses (53–55), concreting of cellars and foundations (9–10), damp-proof courses (17), quality of materials and fireplaces (11, 58), drainage (60), are of especial value in relation to our subject.

Much greater care should be exercised in respect to the warming and ventilation of public buildings. The openings for the latter purpose are for the most part quite inadequate, and the means of extracting foul air are often futile. It is a question also whether the methods used for introducing

warmed air do not generally devitalize it and make it unfit for healthy respiration.

The Model By-laws, moreover, only apply to new streets and buildings, and it is in the old parts of most large towns that the favorite breeding-places of phthisis are to be found. Recent reports by Dr. Russell in Glasgow, and by Dr. Thresh in Manchester, show how entirely unfit are many of these places for healthy habitation, and give evidence of the effects of overcrowding.

Dr. Thresh found, in Ancoats, that "the cubic space per head in the living-rooms and bedrooms in Ancoats is miserably inadequate for sustaining health;" in one case, a man and his wife, with five children, lived in one room—8 ft. 6 in. high, 10 ft. 6 in. long, and 9 ft. 3 in. wide—647 cubic feet in all; and he gives several similar cases in his Report to the Sanitary Association of Manchester.

These abominations in the shape of dwellings ought to be absolutely done away with—razed to the ground if they are incapable of alteration. Back-to-back houses should be converted into double houses with thorough ventilation. Closed streets, courts, and alleys should be opened up, and decent habitable houses built in their places. Breathing-spaces and playgrounds should be left in their midst.

Local authorities have ample powers now for dealing with all these matters.

Numerous acts of Parliament have been passed since the first Laboring Classes Lodging Houses Act of 1851, all of them having for their object the improvement of the dwellings of the working classes. There was one in 1866, and another in 1867, and in 1868 a very stringent measure was passed, commonly called Torrens's Act, but unfortunately it proved unworkable, owing to the absence of clauses giving sufficient compensation to owners of property.

Then, in 1875, came the most important effort in this direction, in Sir Richard Cross's Improvement Act, and it must be a source of no small satisfaction to the members of the Manchester college to know that this and other subsequent measures are mainly due to the representations made by them to the legislature as to the need for such improvement.

Thorough as this act was, however, it also was not found to work well in practice, and several large towns, notably

Edinburgh and Glasgow and Manchester, preferred to obtain private acts of their own, to using the rather cumbrous machinery provided for them in it. Accordingly amending acts were passed in 1879, remedying defects both in Torrens's and Sir R. Cross's acts, and in 1881 further efforts were made in this direction. Finally in 1885, after a royal commission had sat upon the subject and had reported that local authorities really now possessed ample powers—which for the most part they did not use—for improving cottage dwellings, a most important clause was introduced into the housing of the Working Classes Act of 1885, which made compulsory all that was only left permissive before in previous acts.

This clause runs as follows:

"Section 7. It shall be the duty of every local authority intrusted with the execution of laws relating to public health and local government, to put in force from time to time, as occasion may arise, the powers with which they are invested, so as to secure the proper sanitary condition of all premises within the area under the control of such authority."

If the local authority does not carry out this law, then any complainant may apply directly for a mandamus to compel them to do so, without the necessity of appealing first to the Local Government Board at Whitehall.

This is indeed an important clause, and if it is interpreted according to the rights of modern sanitary research, it ought to transform our large towns from their present condition of hotbeds of disease to a collection of smiling abodes of health.

In the matter of atmospheric impurities, cleanliness, light, and ventilation must be our chief resources.

The cleanly housewife's righteous horror of dust has a more scientific basis than she dreams of; as we have seen, it may be the vehicle of disease and death, and is something more than merely "matter in the wrong place." But with the exception of giving her this incentive to an incessant fight against it, I doubt whether we could teach her anything as to the best mode of dealing with it. I should be glad, however, to see all furniture and room-fittings so made as not to be the harborers of dust, with their edges bevelled off or rounded, and it would also be a good thing if the contents of the dust-pan were invariably burnt at once, instead of being stored up in a bin, or carried off to form a huge mound in some town's

yard, many of its lighter particles being carried away by the wind, to add to the other deadly ingredients of a polluted atmosphere.

It is interesting to note, as a result of Professor Carnelly's experiments,[75] that the influence of dirt as a fosterer of micro-organisms in the air has now been placed upon a scientific basis. His conclusions are shown in the following table:

TABLE VIII.—*Effect of Cleanliness.*

		Space per Person.	Carbonic Acid.	Organic Matter.	Micro-Organisms.
One-roomed houses,	Clean.....	295	7.99	2.34	18
	Dirty.....	200	9.87	3.23	41
	Dirtier	221	10.66	2.42	49
	Very dirty.	220	10.01	2.69	93
Two-roomed houses,	Very clean.	273	12.20	1.93	10
	Clean.....	264	9.34	1.37	22
	Dirty	233	9.40	2.03	69
Unventilated Board-schools,	Clean.....	167	19.68	3.25	91
	Average. ..	166	14.17	2.90	125
	Dirtier.....	191	22.47	2.73	198
Ventilated schools,	Very clean.	194	12.50	2.26	3
	Clean... ..	155	12.81	1.48	16
	Less clean..	152	10.78	1.75	30

It will be seen that cleanliness produced a difference of 18 to 93 in the one-roomed houses, 10 to 69 in two-roomed houses, 91 to 198 in unventilated, and 3 to 30 in ventilated schools.

And yet want of cleanliness is not solely responsible for the presence of organized germs.

Sir Henry Roscoe draws the following conclusions from Professor Carnelly's paper to the Royal Society:

(1) That "by mechanical ventilation, the micro-organisms (that is, the excess over and above those contained in the outside air) were nearly one-tenth, the organic matter one-seventh, and the carbonic acid nearly one-half, of what they were in the schools ventilated by ordinary methods, the average cubic spaces in the two schools being practically the same, or, if anything, slightly less in those ventilated mechanically. (2) Notwithstanding this very great improvement in the purity of the air, the temperature is even considerably higher than in the ordinarily ventilated schools; whereas, to produce such an improvement in purity by the ordinary method of opening

windows, etc., would have reduced the temperature to a very uncomfortable and dangerous degree. (3) This improvement is also obtained with little or no perceptible draught, and where a draught is perceptible, it is a warm and not a cold one, as is the case with ventilation by an open window. (4) Mechanical ventilation not only very considerably reduces the number of micro-organisms during the time that it is in action, but has also a marked effect after the ventilation has been stopped and replaced by natural ventilation, for the micro-organisms in the air do not rise to the level of the ordinarily ventilated schools for a considerable time."

It would be well if, in framing by-laws for all kinds of public buildings, and especially for schools, the suggestions made in Sir H. Roscoe's valuable paper could be followed.

Another table shows that the micro-organisms are derived from the rooms themselves.

TABLE IX.

Cubic Space per Person. Cubic Feet.	Naturally Ventilated. No. of Cases.	Carbonic Acid.	Organic Matter.	Total Micro-organisms.	Mechanically Ventilated. No. of Cases.	Carbonic Acid.	Organic Matter.	Total Micro-organisms.
50–100	6	21.5	16.2	119	—	—	—	—
100–150	14	15.5	19.6	128	7	14.0	7.8	23
150–200	5	18.9	12.3	150	8	11.4	9.6	14
200–250	9	21.1	16.8	188	5	11.8	12.3	10
250–300	4	17.1	9.5	187	—	—	—	—
300 and upward	4	15.1	11.8	12	6	13.0	3.7	2

In badly-ventilated schools, micro organisms increase up to a certain point with increase of wall and door space, whereas, in mechanically-ventilated schools, where the air is quickly removed, the micro-organisms decrease with increase of cubic space.

Sir Henry Roscoe says: "We have already seen that cleanliness (see table, p. 267) exerts a most powerful influence on the number of micro-organisms. One would expect that the source of these organisms is the floor, especially the dirt lying about on it."

But that the loose dirt lying about on the surface of the floor is not of itself the chief source seems to follow from two facts. In the first place, one would expect that scrubbing the

floor would have a marked effect on the micro-organisms in the air. To test this, two similar schools were taken; one was scrubbed once a week for five weeks, and the other left unscrubbed. The bacteria were regularly determined in each, with the following result:

TABLE X.

	Scrubbed Room.	Unscrubbed Room.
Average of six days before scrubbing..	112	93
Average of 1st day after scrubbing....	31.5	70.5
" " 2d " " "	133	86
" " 3d " " "	147	112
" " 4th " " "	134	46
" " 5th " " "	108	99
General average after scrubbing.....	111	83

The total effect of scrubbing also was found to be *nil*. The scrubbing would remove the loose dirt, but not the dirt ingrained in the floor.

Another reason against the loose dirt being a main source of contamination is the fact that the infection of a school with micro-organisms takes place very gradually, new schools having much fewer than old ones; and similar results have been obtained by Miguel in new and old houses in Paris. Probably nothing short of total destruction would clear some of the older buildings from micro-organisms.

Even if we suppose that all the precautions so far mentioned could be strictly carried out, much still remains to be done before we can exorcise the demon of tuberculosis.

People must be educated to take advantage of the arrangements that we may hope will be made for their comfort and well-being. At present, many of the inhabitants of both town and country are quite capable of converting a palace into a pig-sty, and the best-laid plans for ventilation and cleanliness may not only "gang aft aglee," but may be deliberately frustrated by the ignorance, carelessness, or active prejudice of the people most concerned to carry them out.

These people will have to be taught the importance of the sanitary regulation of their households, and to this end they must know something of the laws of health, and they should

be assisted to make proper use of the various means that are placed at their disposal.

It would be a most beneficial thing if sanitary associations, or healthy homes societies, similar to those in Manchester, could be established in every town in the kingdom.

I have ventured to suggest to the Sanitary Institute the establishment of such societies, as part of its work in the towns where its congresses are held.

5. Hitherto we have been mainly occupied with the external precautions to be taken against absorbing the tubercular virus. We must turn now to those relating to the sufferer from consumption himself.

First, the treatment of the excretions from tubercular patients. Both the urine and fæces have been found to contain bacilli, and should therefore be disinfected, or otherwise safely disposed of; but we have seen that the most fertile source of infection in phthisis is probably the sputum of such patients expectorated on to the ground, on to floors, or into handkerchiefs, allowed to dry up, and, in the form of dust, permitted to lodge on the walls or in nooks and corners of dwellings, or to float about in all kinds of public assembly-rooms, whether for religious, political, or social meetings. Now we can say at once that this should never be permitted.

Englishmen are rather inclined to sneer at the abundant provision made on the Continent for the reception of expectorated matter, but it might be well for us if we were more cleanly in that respect in this country.

Undoubtedly, if the contents of these receptacles are simply consigned to dust-bins and left to gain virulence, as it is at least possible they may, by contact with organic filth, then the danger of infection from this material may be but little diminished; for when it dries up and portions of it are allowed to fly about in the atmosphere of the streets and lanes of a city, it may spread the disease, through the medium of the very air that we admit to our living-rooms in the laudable desire for ventilation.

But all such receptacles should be filled preferably with some liquid disinfectant, or with sawdust that has previously been charged with some efficient disinfectant, and their contents, like those of the dust-bins, should be scrupulously burnt,

either on kitchen fires, or in a furnace provided for the purpose by town authorities.

It would be well, also, if all phthisical patients would carry with them and use small portable spittoons, that could be carried in the pocket. They can be made for a few pence, and can be lined with paper charged with disinfecting substances, and their contents could readily be consigned to the fire at convenient intervals.

Disinfectants.—Numerous experiments have been made to determine the best means of disinfecting tuberculous material.

In Verneuil's "Études sur la Tuberculose," Dr. P. Villemin gives the results obtained with a prodigious number of different chemical substances. It would be useless to name the hundred-and-one of these bodies that have either given negative results, or that have only somewhat retarded the development of the bacillus. He found, however, that the following ingredients mixed with the cultivating medium completely sterilized it in the proportions which he employed—they are: hydrofluoric and silicic acids, fluosilicates of potassium, sodium, and iron, ammonia, naphthol (α and β), polysulphuret of potassium, tartar emetic, and sulphate of copper. (Among the class of substances that greatly retard the development of the bacillus, he places arsenious, boric, picric, pyrogallic, and sulphurous acids; benzin, chloroform, creosote, hyposulphite of soda, iodoform, menthol, phenate of soda, salol, and toluene. And he places in a third category those substances in which growth took place, but with some difficulty; among these we find acetone, aldehyde, biniodide of mercury, bromides of potassium, sodium, and ammonia; caffeine, camphor, chlorhydrate of ammonia, turpentine, eucalyptol, iodide of potassium, naphthalin, resorcin, sulphates of soda, magnesia, quinine, and zinc, thymol, and tungstate of soda.)

Dr. de Souza found that the following substances prevented all development: Mercuric ethyl, in the proportion of 1 in 35,000; benzoate of ethyl, 1 in 3,000; benzoate of methyl, 1 in 12,000; but menthol and iodoform had only a retarding influence.

Schill and Fischer ("Mitth. aus dem k. Gesundheitsamte") found corrosive sublimate most efficient; Sormani and Brugnatelli,[76] brom-ethyl, palladium and mercuric chlorides, carbolic

acid, creosote, naphthol, and saturated solutions of camphor in alcohol, lactic acid, and turpentine.

Unquestionably tuberculous material cannot be left to take care of itself. The various natural disinfecting agents, with perhaps the sole exception of fresh air and light, seem to be wholly inadequate to deal with it.

M. Galtier[77] has succeeded in inoculating tubercle with the juice of muscle, from tuberculous animals, after it has been raised, for twenty minutes, to a temperature of 60° C., and for ten minutes to a temperature of 71°, temperatures which, he says, are not exceeded in the centre of a large piece of meat cooked on the gridiron.

Desiccation, putrefaction (for ten to twenty days), freezing at temperatures from 3° to 8° below zero (C.), alternate freezing and thawing—none of these conditions destroy the infective power of tuberculous matter.

He found also that the urine of tuberculous animals was virulent, and he draws the conclusion that "it is indispensable to insist upon the disinfection of all objects soiled by tuberculous animals, of their excretions, of places they have occupied, of the dung-heaps, etc., in order to prevent the dissemination of the disease, and its transmission to man."

At the Manchester Hospital for Consumption we have been in the habit of using for the spit-cups a solution of mercuric chloride, 1 in 500, and I have also used "salufer," a fluosilicate, introduced by Mr. W. Thomson, of Manchester.

If the stools and urine of phthisical patients have to be disinfected, probably the best agents would be sulphate of copper, or sulphate of iron, or carbolic acid; but where water-closets are used, there is probably not much danger from this source.

It is recommended by Dr. Cornet and others that after the death of a phthisical patient, the rooms, and bedding, and clothes should be thoroughly disinfected, as after a death from a contagious disease, and a thorough cleansing of the whole premises.

There can be no doubt that this practice—at present, so far as I know, limited to Italy and Spain—ought to be universal.

If all the suggestions that have so far been made were to be carried into effect to any large extent, we might, I think,

fairly hope that in a few years there would be a considerable reduction of the phthisis death-rate; but, after all efforts in this direction have been made, there will probably still remain a large number of persons, actually suffering from the disease, who will escape from the net of precautions that we have endeavored to cast around them; and in their heedlessness and contempt of danger to themselves and others, they will continue to spread about the seeds of disease, and thus susceptible individuals will still continue to contract the complaint.

It becomes a serious question for the public and for the state, whether persons suffering from consumption, if they are "without proper lodging and accommodation" for preventing infection, should not be provided with asylums or hospital accommodation, until the disease is either cured or ends in death.

Enormous sums have been spent in the past, in the isolation of persons suffering from leprosy, a disease strictly analogous to phthisis, only still more chronic, and less easy to control by such a method. It would certainly be far easier to cleanse away and destroy phthisical sputum, than to prevent contamination from leprous sores.

If a poor country like Norway can provide asylums for a large proportion of its lepers, it is not too much to ask Great Britain to make the attempt to segregate those consumptives who are likely to be a source of danger to the community.

At the present time, the accommodation for cases of phthisis is very small. They are entirely shut out from most general hospitals, although they are admitted as out-patients to all dispensaries, and are thus free to scatter abroad the infective material in places where many persons peculiarly prone to the disease are sure to congregate.

The special hospitals for consumption are very few in number. They may almost be counted upon one's fingers: thus there are in the metropolis four such institutions, including the great Brompton Hospital, and together containing 615 beds.

At Bournemouth also there is the auxiliary sanatorium with 62 beds.

At Torquay (48), Ventnor (140), and St. Leonards (18), there are special hospitals, with an aggregate of 206 beds.

Possibly, also, at some of the numerous cottage-hospitals, cases may occasionally be taken in.

The only manufacturing towns in England to which such hospitals are attached are Liverpool, with 50 beds, Manchester with 37.

The workhouse hospitals are the chief refuges for destitute consumptives; but Dr. Bridges informs me that there are no data from which to ascertain how many of them are thus accommodated.

In any case there are certainly large numbers of persons suffering from active disease who are without proper means of treatment, and who are permitted to mix freely with the rest of the community.

I am well aware that, at the first blush, these proposals will be regarded by most people as stupendous, and perhaps as entirely impracticable; and if it was intended to provide for even a moiety of the consumptives of the country, they might rightly be so regarded. It would, in this case, mean an expenditure of several millions; and even if this amount were forthcoming, the social difficulties in the way would be still greater, for it would involve the separation of families, and, moreover, many consumptives are the sole bread-winners or guardians of families, and could not leave them.

But I do not seek for anything so gigantic as this would imply. I would simply ask that phthisis should be placed in the same list with other diseases requiring special measures to prevent its spread. Although, as before said, phthisis is not directly contagious, I venture to contend that there would be nothing unreasonable in thus classing the disease. Under the recently-passed Notification of Diseases Act, many local authorities have included enteric fever in their schedules—a disease strictly analogous, in that it is rarely, if ever, directly infectious, but which spreads mainly by means of excretions from the patients.

There would also be nothing strained in interpreting the words of the Public Health Act, 1875, in the clauses relating to infectious diseases, "without proper lodging and accommodation," so that they should mean that special measures must be put in force to prevent people from sowing broadcast the virulent particles coughed up from their diseased respiratory organs.

My proposition briefly would be this, that phthisis should be classed with other infective disorders; that every case, as

soon as it is discovered, should be notified to the medical officer of health. If necessary, it should be visited, to ascertain whether proper care is, or can be, taken to prevent injury to the public health. Where the case is that of a poor person, the local authority should see to the regular cleansing and whitewashing of the premises, and to the disposal of excretions, including especially the expectorated material. They should also inquire into, and rectify if necessary, the drainage and ventilation of the dweling; and after death, special measures should be taken for the cleansing and disinfection of house, bedding, and clothes.

After all this had been done for the safety of the non-phthisical portions of the family, there would next come the question of the propriety or possibility of removing the sick person to hospital. So long as he (or she) could work, and so long as he would consent to use the necessary means for destroying the infective material, it would be unnecessary to do more than I have already indicated; but when the patient becomes unable to follow his employment, and the family are obliged to seek for assistance from the parish, he has a claim to be received into the workhouse hospital, and such an asylum should be offered to him, and should be made as little humiliating and as free from ignominy as possible. When such a hospital is efficiently administered, as it should be, and often is now, when the nursing is performed in a kindly fashion, on Miss Nightingale's principles, and the patient is not left to the ministrations of any able-bodied pauper, as is sometimes the case; and when appropriate care is taken for the cleanly disposal of excreta of all kinds, then there could probably be no better fate in store for the poor invalid, and he might even soon be restored to his family, and be able to return to his work.

I would also put in a plea for those who are not reduced to pauperism, but who could be removed to hospital to receive appropriate treatment in its wards. Toward the close of their illness, persons who live in close, confined dwellings become a serious source of danger to the rest of the family, and as they are "without proper lodging and accommodation" for the safe treatment of such a disease, I would submit that it would be a legitimate expenditure on the part of local authorities, if they were to provide male and female wards for the recep-

tion of such cases, in connection with their hospitals for infectious diseases. Although consumption is not directly infectious, its products are undoubtedly infective under certain conditions such as have been mentioned, and local boards would be taking the right measures for preventing the spread of disease if they were to make such provision. There are probably few exanthematous diseases that could be so easily and effectively controlled.

But there would still remain a wide field open to private benevolence in the provision of sanatoriums or homes for these unfortunates.

I can conceive few objects better calculated to excite the compassion of all humane people than the condition of many of these poor sufferers, who are shut out from the benefits of general hospitals.

Most people have had an opportunity, some time in their lives, of watching the course of this insidious malady, and have witnessed the scenes of weakness and suffering that attend its later stages. And if it is painful to contemplate its ravages in those who are well-to-do, and surrounded by all the alleviations that can be brought to bear by medical science, how much more sad must it be in the homes of the poor, with scanty attendance, imperfect nursing, and with a lack of all kinds of comforts for the sick.

I can scarcely think that there would be much difficulty in raising the funds necessary for the care of such cases as are not yet reduced to pauperism, but who are really destitute of the appliances and comforts so necessary to a slowly-fading life.

The chief difficulty in the way would lie with two classes of objectors.

1. There are some practically-minded men who are not destitute of benevolent impulses, but who are wishful to see the useful application of the money they are willing to expend. They may have hesitated in the past, and may reasonably still hesitate, to give anything toward an object which they consider is tantamount to being merely an attempt to smooth the pillow of the dying. These men look upon hospitals for consumptives as asylums for the dying, and they would write over them Dante's inscription over the portal of hell, "Lasciate ogni speranza, voi ch' entrate."

We have already seen that this objection is based upon entirely erroneous information as to the curability of the disease, but it is not the less likely to have a certain amount of weight.

2. There are again others who believe that those who endeavor to preserve the lives of these poor wretches, are doing a positive injury to the future of the human race.

This view, again, is based upon erroneous views as to the nature of the hereditary transmission of tubercle. We have abundant reasons for believing that—by means of the destruction of the breeding-grounds of phthisis, and by improved hygienic measures, together with proper precautions against infection—the hereditary tendency to the disease would die out in a few generations, and that a healthy race would survive, free from tubercular taint, and endowed with the vivid intelligence and bright social attributes which are well known to be so common among those who now often succumb to the disease.

But to both these classes of objectors, as well as to others who have less excuse for parsimony in this regard, I would, in addition to meeting their arguments, adduce the powerful plea of self-interest.

Measures such as I have indicated would greatly diminish the danger of contracting the disease. Not only would some cases be entirely cured, but all of them would be restrained from spreading abroad the peculiar virus that might otherwise find a home in some susceptible system.

Moreover, such hospitals would be centres from which would spread enlightened opinions respecting the proper treatment of the complaint, and they would be the means of preventing its further extension.

I do not hesitate to say that, at present, the hospital accommodation for cases of phthisis is most inadequate, and that in place of the half-dozen of such institutions outside the metropolis, there ought to be hundreds of them scattered about the country, in suitable localities and attached to all the chief centres of the population.

The map of the distribution of leper-houses in England shows what large provision was made for leprosy at a time when the population was not much more than one-tenth of its present amount, and it is possible that advantage might be

taken of some of the funds left for that purpose, to apply them to the treatment of a strictly analogous and closely allied form of disease.

I am glad to be able to quote Dr. Coats, of Glasgow, who is a high authority on this subject, in favor of the scheme now put forth. In his "Lectures to Practitioners" (Longmans, Green & Co.), p. 211, he says.

"It may possibly in the future come to be a practical sanitary question whether consumptive patients should not, in some way, be isolated from the general community. There can be no doubt that their presence in the general community, by continually breeding and giving out large quantities of tubercular bacilli, supplies one of the necessary elements in the propagation of all tubercular disease; it may indeed be a question whether, in the interests of the patients themselves, as well as of the community at large, it will not be advisable to undertake their treatment in isolated special hospitals. If consumptives were treated in sanatoriums, placed in dry, airy situations, and with efficient ventilation in-doors, as well as the opporunity of sufficient out-door exercise, then surely there would be a much larger proportion of cures than can be looked for under present circumstances." He also adduces the example of leprosy and its treatment by isolation, and its success, as a case in point.

In conclusion, perhaps I may be allowed to say a few words as to the principles that should guide us in endeavoring to check the disease at its outset.

This point is indeed strictly germane to our subject of the prevention of phthisis, for if we could succeed in arresting its progress in a certain number of cases, we should by so much diminish the chance of its spreading to others.

I. May I point out the unsatisfactory results that have arisen so far from the various researches that have been made for the purpose of killing the bacillus *in situ* of late years? The efforts of many physicians have been directed to this object, and the treatment, whether by inhalations, by sulphuretted hydrogen injections, or by germicide medicines, has had the one principle of endeavoring to destroy the bacillus after its entrance into the lungs. I was myself at one time beguiled into making attempts in this direction, but I have long been convinced of the extreme improbability of our

ever reaching the organisms in their hiding-places in the lung.

A very little study of the pathology of the disease will convince most men that when the organism is hedged round, as it usually is, with the products of inflammatory action, with exudation cells or fibroid material, and at a distance from vascular supply, it is almost hopeless to expect to reach it either through the air-passages or by the currents of the blood.

Let us have "war to the bacillus," by all means, but it must be war carried on outside the body and not within it. When once it is intrenched behind its barrier of exudative material, its individual existence, so far as we know, is safe against all our attacks.

II. What we have to do, after preventing reinforcements from being poured in from the outside, is to combat the irritation and inflammation caused by its presence by ordinary antiphlogistic measures, and then, by all the means in our power, so to strengthen the bodily forces as to enable them to deal with the invaders. If these receive no accession from without, and if they can be prevented from generating poisonous matter, more powerful for evil than themselves, they will generally succumb, either by starvation, or by being dried up, or got rid of by ordinary necrosis and suppuration.

To leave metaphor, I believe that our chief reliance must be placed upon means for reinvigorating the system—dietetic, hygienic, and medicinal.

III. At the same time, I would by no means discourage attempts to preserve adjacent structures and the rest of the body from attack. Certain of the inhalations most commonly used, such as carbolic acid, creosote, eucalyptus, oil of pine, menthol, iodine, etc., are probably of service in this direction, and some of them serve to control excessive secretion, and to render the mucous surfaces generally more healthy. It may be possible also that certain medicines, which have been proposed for this purpose, may prove, upon extended trial, to have the due preservative effect, and, hence, observations are needed upon the action of such drugs as tannin, creosote, iodoform, arsenic, salts of copper, etc., though I should myself give precedence to such as have been proved to increase the body-weight and to improve nutrition generally.

At the Manchester Hospital for Consumption a series of observations has been carried on for some years upon the action of different drugs, such as iodoform, the hypophosphites, guaiacol, creosote, tannin, and, latterly, upon the inhalation of pure ozonized oxygen; but it has been somewhat difficult to discriminate between the action of these substances and the general good influence of the hospital itself. Other workers in this field have also contributed evidence on this subject, but it is scarcely within the scope of this inquiry to attempt to sum up the results of these observations.

It may, however, be of some service if I remark again upon the inhalation of ozonized oxygen, which, so far as I know, as only been used as yet in the Manchester hospital, so far with encouraging results.

It was first tried in consequence of the well-known beneficial action of pure mountain and sea air, and it was thought possible that some of this benefit might be due to the ozone contained in such air. After ascertaining that pure oxygen when ozonized up to 9 or 11 per cent might be inhaled in considerable quantities without exciting inflammatory action, it was administered regularly to fifteen patients in all stages of the complaint, and the results were very marked in procuring improvement in general health—better appetite, sounder sleep, freedom from fever, and consequent gain in weight.[78]

And yet it certainly had no obvious germicidal action in many of the cases; though the amount of expectoration was diminished, there was but little difference to be noted in the number of bacilli on the microscopic slides.

IV. So far as I know, all the attempts that have been made, hitherto chiefly in France,[79] to discover an anti-bacillary vaccine, with which to render the tissues antagonistic to the bacillus, have signally failed; and although I would not object to further researches in this direction, it appears to be hardly likely that they will be successful against a complaint in which one attack confers no immunity against a second.

V. Hitherto the best results that have been obtained in the cure of consumption have been due to abundant supplies of fresh air and light and good food, with a large abundance of fat in an easily-assimilated condition, and to medicines that have assisted the general nutrition of the body.

VI. But if the question were to be addressed to medical

men by the Collective Investigation Committee, as to what simple measure has done most toward the cure of consumption, I believe the answer would be almost unanimous in favor of change of residence. In many instances, no doubt, the improvement would be ascribed to change of climate, and sometimes Egypt or Algiers, sometimes Davos, or Canada, or the Riviera, would receive the praise. Much good must undoubtedly arise from the favorable conditions to be found in these places, but I venture to ascribe a large proportion of the cures to the simple fact of removal from an infected area, to places where the air is free from active virus—and hence I am at one with those who believe that healthy homes for consumptives may be found in this country.

I have made these few remarks in the belief that my readers would prefer me to state plainly the convictions that have grown upon me in the course of a practice during which diseases of the lungs have long been especially the object of my study.

But all the conclusions now stated are obviously subject to revision in the light of evidence that may be forthcoming as the result of further research. (I would call attention to Dr. Vincent Harris's recent paper "On the Antiseptic Treatment of Phthisis" ("St. Barth.'s Hosp. Reports," XXV., 49); but I may observe that equally good results have been obtained in hospitals, apart from the use of antiseptic inhalations.)

The subject is still *sub judice*, but when the final judgment comes to be pronounced I only hope that there will remain sufficient ground for encouragement to persevere in the task of meeting and ultimately annihilating this terrible disease.

From a review of the course of this complaint in the past, and of its affinities with other preventible disorders—from our knowledge of its pathology, and of the influences most favorable to its spread—from our experience of its steady diminution within the last thirty years, and from the brief *résumé* of the measures that may be taken to arrest its course—from all these points we may surely learn to regard it as a preventible disease, and may look forward to its further diminution, if not to its ultimate extinction as a cause of death.

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